

# SPECIFICATIONS FOR



**Bid No. 7093 - Central Valley  
Continuation High School  
Modernization (Measure 'E' Bond)**

## **Volume II Technical Specifications Division 1 - 33**



***DVBE COMPLIANCE AND DEPARTMENT OF INDUSTRIAL  
RELATIONS (DIR) PUBLIC WORKS COMPLIANCE MONITORING***

**KERN HIGH SCHOOL DISTRICT  
Michael Zulfa, Ed.D., Superintendent**

IDENTIFICATION STAMP  
DIV. OF THE STATE ARCHITECT

APP: 03-125726 INC:

REVIEWED FOR

SS ☒ FLS ☒ ACS ☒

DATE: 04/28/2026

SECTION 00 01 20

ARCHITECT AND ENGINEERS SEALS

PROJECT

**CENTRAL VALLEY CONTINUATION HIGH SCHOOL**

526 Mannel Avenue, Shafter, CA 93263

SGPA Project Number 22434\_E-02

OWNER

**Kern High School District**

Bakersfield, California

ARCHITECT

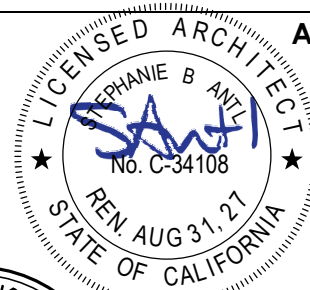
**SGPA Architecture and Planning**

3111 Camino del Rio North, Suite 500

San Diego, California 92108

Phone: (619) 297-0131

www.sgpa.com



CONSULTANTS

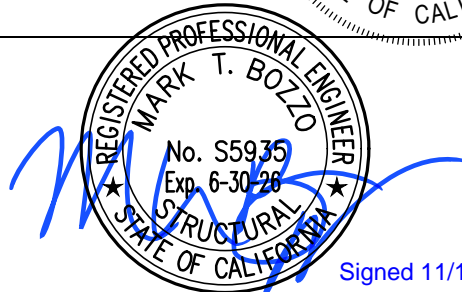
**STRUCTURAL**

**Advanced Structural Design, Inc**

7112 N. Fresno St, Suite 311

Fresno, CA 93720

Tel: 559.432.4151



Signed 11/17/2025

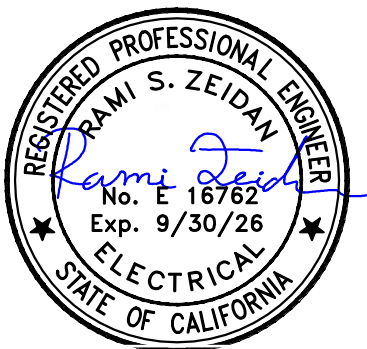
**MECHANICAL/PLUMBING/ELECTRICAL/TECHNOLOGY/FIRE ALARM/FIRE PROTECTION**

**LP Engineers**

1209 Pleasant Grove Blvd

Roseville, CA 95678

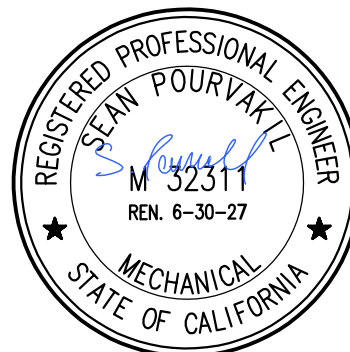
Tel: (916) 771.0778



Signed 11/17/2025



Signed 11/17/2025



Signed 11/17/2025

Central Valley CHS

Shafter, CA

DSA Submittal - Feb. 27, 2026

ARCHITECT AND  
ENGINEERS SEALS

00 01 20 - 1

**CIVIL**

**Swanson Engineering**

2000 Oak Street, Suite 150  
Bakersfield, CA 93301  
Tel: 661.831.4919



11-17-25

**LANDSCAPE**

**Rios Design Studio**

3805 Ora Vista Ave  
Bakersfield, CA 93309  
Tel: 661.835.9259



exp 9/30/26

DSA APPROVALS

END OF SECTION 00 01 20

Central Valley CHS  
Shafter, CA  
DSA Submittal - Feb. 27, 2026

ARCHITECT AND  
ENGINEERS SEALS  
00 01 20 - 2

KERN HIGH SCHOOL DISTRICT  
**TABLE OF CONTENTS**

**BID NO. 7093 – CENTRAL VALLEY CONTINUATION HIGH SCHOOL  
MODERNIZATION (MEASURE ‘E’ BOND)**

**VOLUME II TECHNICAL SPECIFICATIONS  
DIVISION 1 - 33**

**DIVISION 1    GENERAL REQUIREMENTS**

01 10 00	Summary
01 20 00	Allowances
01 25 00	Substitution Procedures
01 31 00	Project Management and Coordination
01 32 00	Construction Progress Documentation
01 33 00	Submittal Procedures
01 40 00	Quality Requirements
01 42 00	References
01 50 00	Temporary Facilities and Controls
01 60 00	Product Requirements
01 73 00	Execution
01 74 19	Construction Waste Management and Disposal
01 77 00	Closeout Procedures
01 78 23	Operation and Maintenance Data
01 78 39	Project Record Documents
01 79 00	Demonstration and Training
01 91 00	General Commissioning Requirements

**DIVISION 2    NOT USED**

**DIVISION 3    CONCRETE**

03 30 00	Cast-in-Place Concrete
03 35 43	Polished Concrete Finishing

**DIVISION 4    MASONRY**

04 22 00	Concrete Unit Masonry
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**DIVISION 5    METALS**

05 12 00	Structural Steel Framing
05 31 00	Steel Decking
05 50 00	Metal Fabrications

**DIVISION 6    WOOD AND PLASTIC**

06 10 00	Rough Carpentry
06 41 13	Wood-Veneer-Faced Architectural Cabinets
06 41 16	Plastic-Laminate-Clad Architectural Cabinets
06 64 00	Plastic Paneling

**DIVISION 7    THERMAL AND MOISTURE PROTECTION**

07 21 00	Thermal Insulation
07 25 00	Weather Barriers
07 41 13	Metal Roof Panels
07 46 46	Fiber-Cement Siding



**DIVISION 7 THERMAL AND MOISTURE PROTECTION (CONTINUED)**

07 54 19 Polyvinyl-Chloride (PVC) Roofing  
07 62 00 Sheet Metal Flashing and Trim  
07 72 00 Roof Accessories  
07 92 00 Joint Sealants

**DIVISION 8 DOORS AND WINDOWS**

08 11 13 Hollow Metal Doors and Frames  
08 14 16 Flush Wood Doors  
08 31 13 Access Doors and Frames  
08 41 13 Aluminum-Framed Entrances and Storefronts  
08 51 13 Aluminum Windows  
08 71 00 Door Hardware  
08 80 00 Glazing

**DIVISION 9 FINISHES**

09 29 00 Gypsum Board  
09 30 13 Ceramic Tiling  
09 51 13 Acoustical Panel Ceilings  
09 65 13 Resilient Base and Accessories  
09 65 19 Resilient Tile Flooring  
09 68 13 Tile Carpeting  
09 77 00 Special Wall Surfacing  
09 84 00 Acoustical Room Components  
09 91 13 Exterior Painting  
09 91 23 Interior Painting

**DIVISION 10 SPECIALTIES**

10 11 00 Visual Display Units  
10 12 00 Display Cases  
10 14 19 Dimensional Letter Signage  
10 14 23 Panel Signage  
10 14 26 Post and Panel/Pylon Signage  
10 21 13.19 Plastic Toilet Compartments  
10 28 00 Toilet, Bath, and Laundry Accessories  
10 44 13 Fire Protection Cabinets  
10 44 16 Fire Extinguishers  
107 5 16 Ground Set Flagpoles

**DIVISION 11 EQUIPMENT**

11 40 00 Foodservice Equipment

**DIVISION 12 FURNISHINGS**

12 24 13 Roller Window Shades  
12 36 00 Countertops  
12 48 13 Entrance Mats and Frames

**DIVISION 13 – 20 NOT USED**

**DIVISION 21 FIRE SUPPRESSION**

21 05 00 Common Work Results for Fire Suppression  
21 05 23 General Duty Valves for Water-Based Fire Suppression Piping  
21 05 53 Identification for Fire Suppression Piping and Equipment  
21 13 00 Fire-Suppression Sprinkler Systems

**DIVISION 22 PLUMBING**

22 05 10	Plumbing General Provisions
22 05 16	Expansion Fittings and Loops for Plumbing Piping
22 05 23	General-Duty Valves for Plumbing Piping
22 05 29	Hangers and Supports for Plumbing Piping and Equipment
22 05 53	Identification for Plumbing Piping and Equipment
22 07 19	Plumbing Piping Insulation
22 08 00	Plumbing Commissioning Requirements
22 10 05	Plumbing Piping
22 10 06	Plumbing Piping Specialties
22 30 00	Plumbing Equipment
22 40 00	Plumbing Fixtures

**DIVISION 23 HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)**

23 05 10	Mechanical General Provisions
23 05 29	Hangers and Supports for HVAC Piping and Equipment
23 05 53	Identification for HVAC Piping and Equipment
23 05 93	Testing, Adjusting, and Balancing for HVAC
23 07 13	Duct Insulation
23 07 19	HVAC Piping Insulation
23 08 00	Mechanical Commissioning Requirements
23 09 24	Direct-Digital Control System for HVAC
23 23 00	Refrigerant Piping
23 31 00	HVAC Ducts and Casings
23 33 00	Air Duct Accessories
23 34 23	HVAC Power Ventilators
23 37 00	Air Outlets and Inlets
23 74 13	Packaged Outdoor Central-Station Air-Handling Units
23 81 26	Small-Capacity Split-System Air Conditioners

**DIVISION 24 – 25 NOT USED****DIVISION 26 ELECTRICAL**

26 05 00	Common Work Results for Electrical
26 05 19	Low-Voltage Electrical Power Conductors and Cables
26 05 26	Grounding and Bonding for Electrical Systems
26 05 29	Hangers and Supports for Electrical Systems
26 05 33.13	Conduit for Electrical Systems
26 05 33.16	Boxes for Electrical Systems
26 05 48	Vibration and Seismic Controls for Electrical Systems
26 05 53	Identification for Electrical Systems
26 05 73	Power System Studies
26 05 83	Wiring Connections
26 08 00	Electrical Commissioning Requirements
26 09 23	Lighting Control Devices
26 21 00	Low-Voltage Electrical Service Entrance
26 22 00	Low-Voltage Transformers
26 24 13	Switchboards
26 24 16	Panelboards
26 27 13	Electrical Metering
26 27 26	Wiring Devices
26 28 13	Fuses
26 28 16.16	Enclosed Switches
26 31 00	Photovoltaic Collectors
26 33 23	Central Battery Equipment

**DIVISION 26 ELECTRICAL (CONTINUED)**

26 43 00 Surge Protective Devices  
26 51 00 Interior Lighting  
26 560 0 Exterior Lighting

**DIVISION 27 COMMUNICATIONS**

27 00 00 Communications Administration  
27 05 00 Common Work Results for Communications  
27 11 00 Equipment Rooms and Enclosures  
27 11 23 Communication Cable Management & Ladder Rack  
27 13 00 Communication Backbone Cabling  
27 15 00 Communication Horizontal Cabling  
27 16 00 Connecting Cords  
27 41 00 Audio-Visual Systems  
27 51 23 Intercommunication Program Systems  
27 51 26 Assistive Listening Systems  
27 53 13 Clock Systems

**DIVISION 28 ELECTRONIC SAFETY AND SECURITY**

28 10 00 Access Control  
28 20 00 Video Surveillance  
28 31 00 Intrusion Detection  
28 46 00 Fire Detection and Alarm

**DIVISION 29 – 30 NOT USED****DIVISION 31 EARTHWORK**

31 10 00 Site Clearing  
31 22 00.10 Earthwork  
31 23 17 Trenching  
31 23 23 Backfilling

**DIVISION 32 EXTERIOR IMPROVEMENTS**

32 12 16 Asphaltic Concrete Paving  
32 13 13 Sitework Concrete  
32 17 13 Parking Bumpers  
32 17 23 Pavement Markings  
32 17 26 Tactile Warning Surfacing  
32 31 13 Chain Link Fences and Gates  
32 31 19 Decorative Metal Fences and Gates  
32 80 00 Irrigation  
32 92 19 Seeding  
32 9 223 Sodding  
32 93 00 Trees, Plants, and Ground Cover

**DIVISION 33 UTILITIES**

33 11 00 Water System  
33 31 00 Sanitary Sewage System  
33 41 00 Storm Drain Systems

## **SECTION 01 10 00**

### **SUMMARY**

#### **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.

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Project information.
  - 2. Work covered by Contract Documents.
  - 3. Work by District.
  - 4. District-furnished products.
  - 5. Access to site.
  - 6. Coordination with occupants.
  - 7. Work restrictions.
  - 8. Specification and drawing conventions.

##### **1.3 PROJECT INFORMATION**

- A. Project: Central Valley Continuation High School
- B. Project Description: New high school campus built on existing athletic fields including new administration and classroom building, cafeteria, kitchen, and classroom building, steel canopy structure, and site improvements.
- C. Project Location: 526 Mannel Avenue, Shafter, CA 93263.
- D. District: Kern High School District
- E. District Address: 5801 Sundale Avenue, Bakersfield, CA 93309
- F. Architect Identification: SGPA Architecture and Planning.
- G. Commissioning Authority (CxA): LP Consulting Engineers Inc.

##### **1.4 CONTRACT**

- A. The Project will be constructed under a single prime contract.

## **1.5 WORK BY DISTRICT**

- A. General: Cooperate fully with District so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by District. Coordinate the Work of this Contract with work performed by District.
- B. Subsequent Work: District will perform the following additional work at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.
  - 1. Final connections to the switch.

## **1.6 DISTRICT-FURNISHED PRODUCTS**

- A. District will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing District-furnished products.
- B. District-Furnished Products:
  - 1. Soap Dispensers.
  - 2. Discus Cage
  - 3. Shot put ring
  - 4. LAN equipment including switches, servers, and network operating software.
- C. Provide District Construction Manager 15 days' prior notice of requirements for delivery to site of all District furnished products. Notify District in writing within 7 days of receiving District furnished products of acceptance or rejection of products furnished. District Construction Manager, after receiving notice, will take appropriate action to have District furnished products made acceptable for Contractor's use. Carefully store and protect from damage rejected District furnished products until District takes appropriate action.

## **1.7 ACCESS TO SITE**

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  - 1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to District, District's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    - a. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

## **1.8 COORDINATION WITH OCCUPANTS**

- A. Partial District Occupancy: District will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with District during construction operations to minimize conflicts and facilitate District usage. Perform the Work so as not to interfere with District's operations. Maintain existing exits unless otherwise indicated.
  - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from District and authorities having jurisdiction.
  - 2. Provide not less than 72 hours' notice to District of activities that will affect District's operations.
- B. District Limited Occupancy of Completed Areas of Construction: District reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

## **1.9 WORK RESTRICTIONS**

- A. Work Restrictions, General: Comply with restrictions on construction operations.
  - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work to hours indicated in General Conditions modified by the Supplementary Conditions. Exceptions to these hours include utility shutdowns and noisy activity.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by District or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
  - 1. Notify District not less than seven days in advance of proposed utility interruptions.
  - 2. Obtain District's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate with District operations that may result in high levels of noise and vibration, odors, or other disruption to District occupancy or neighboring properties.
  - 1. Notify District not less than seven days in advance of proposed disruptive operations.
  - 2. Obtain District's written permission before proceeding with disruptive operations.
- E. Controlled Substances: Use of tobacco products and other controlled substances on District property is not permitted.

## **1.10 SPECIFICATION AND DRAWING CONVENTIONS**

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
  - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
  - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
  - 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION - NOT USED**

## **END OF SECTION**



## **SECTION 01 21 00**

### **ALLOWANCES**

#### **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.

##### **1.2 SUMMARY**

- A. Section includes administrative and procedural requirements governing allowances.

##### **1.3 DEFINITIONS**

- A. Allowance is a quantity of work or dollar amount established in lieu of additional requirements, used to perform services or defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order (CO).

##### **1.4 ACTION SUBMITTALS**

- A. Submit proposals for purchase of products, systems, or services included in allowances, in the form specified.

##### **1.5 INFORMATIONAL SUBMITTALS**

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

##### **1.6 COORDINATION**

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

##### **1.7 ALLOWANCES**

- A. Use allowance only as directed by District for District's purposes and only by APRs

that indicate amounts to be charged to the allowance.

- B. Allowance includes cost of materials, equipment, delivery, receiving, handling, labor, installation, warranty, and insurance. Contractor's supervision, overhead, profit and bond costs to be determined at time of use.
- C. At Project closeout, credit unused amounts remaining in the allowance to District by Change Order.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.1 SCHEDULE OF ALLOWANCES**

- A. Allowance No. 1: For <Insert item>, as directed by District. Include a <Insert allowance type> allowance of \$ Insert amount>.
- B. Allowance No. 2: For <Insert item>, as directed by District. Include a <Insert allowance type> allowance of \$ Insert amount>.
- C. Allowance No. 3: For <Insert item>, as directed by District. Include a <Insert allowance type> allowance of \$ Insert amount>.

**END OF SECTION**

**SECTION 01 25 00**  
**SUBSTITUTION PROCEDURES**

**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.

**1.2 SUMMARY**

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
  - 1. Section 01 21 00 "Allowances" for products selected under an allowance.
  - 2. Divisions 02 through 33 Sections for specific product and manufacturer requirements and for limitations on substitutions.

**1.3 DEFINITIONS**

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor. Substitutions include "or equal" products.

**1.4 ACTION SUBMITTALS**

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use form provided at the end of this Section.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
    - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by District and separate contractors that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as

performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - e. Samples, where applicable or requested.
  - f. Certificates and qualification data, where applicable or requested.
  - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and Districts.
  - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
  - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - k. Cost information, including a proposal of change, if any, in the Contract Sum.
  - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
  - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

## **1.5 QUALITY ASSURANCE**

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

## **1.6 PROCEDURES**

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

## **PART 2 PRODUCTS**

### **2.1 SUBSTITUTIONS**

- A. Submit requests for substitution not later than 35 days after the Notice to Proceed.
  - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
    - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    - b. Substitution request is fully documented and properly submitted.
    - c. Requested substitution will not adversely affect Contractor's construction schedule.
    - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
    - e. Requested substitution is compatible with other portions of the Work.
    - f. Requested substitution has been coordinated with other portions of the Work.
    - g. Requested substitution provides specified warranty.
    - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

## **PART 3 EXECUTION - NOT USED**

**END OF SECTION**

## SUBSTITUTION REQUEST FORM

### A. PROJECT DESCRIPTION

1. Project:
  2. Architect: SGPA Architecture and Planning
  3. Architects Job Number:
  4. Contractor:
- 

### B. PROPOSED SUBSTITUTION

1. Specified Product:
- 

2. Project Manual Section: \_\_\_\_\_ Page: \_\_\_\_\_ Item No. \_\_\_\_\_

3. Proposed Substitution:

a) Description: \_\_\_\_\_

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b) Manufacturer/Name/Rep/Phone: \_\_\_\_\_

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### C. CONTRACTORS REPRESENTATIONS

1. The proposed product meets or exceeds specification requirements?  
\_\_\_\_\_ Yes \_\_\_\_\_ No.
2. Will Changes be required to project design in order to properly install the proposed product? \_\_\_\_\_ Yes \_\_\_\_\_ No. If yes, please explain:  
\_\_\_\_\_  
\_\_\_\_\_
2. Contractor is responsible for all changes to the project design, including engineering and drawing costs, caused by requested substitution?  
\_\_\_\_\_ Yes \_\_\_\_\_ No.
4. Does substitution affect drawing dimensions? \_\_\_\_\_ Yes \_\_\_\_\_ No. If yes, please explain: \_\_\_\_\_  
\_\_\_\_\_

5. What affect does the substitution have on other trades?

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6. Proposed product is subject to and complies with all requirements of the specifications, including warranties. \_\_\_\_\_ Yes \_\_\_\_\_ No.

7. Will proposed substitution affect progress schedule or completion of work? \_\_\_\_\_  
Yes \_\_\_\_\_ No. If yes, please explain: \_\_\_\_\_

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8. Will maintenance and service parts be locally available for proposed substitution?  
\_\_\_\_\_ Yes \_\_\_\_\_ No.

9. Will proposed substitution require more license fees or royalties than specified product?  
\_\_\_\_\_ Yes \_\_\_\_\_ No.

10. Will proposed product meet all requirements of reviewing agencies?  
\_\_\_\_\_ Yes \_\_\_\_\_ No. If no, please explain:

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11. Summarize differences in product characteristics between proposed substitution and specified item.

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12. Proposed substitution by:  
Representative:

---

Company:

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Address:

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Phone:

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D. ARCHITECTS EVALUATION:

Accepted: \_\_\_\_\_

Accepted As Noted: \_\_\_\_\_

Rejected: \_\_\_\_\_

Received Too Late: \_\_\_\_\_

By: \_\_\_\_\_

Date: \_\_\_\_\_



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Remarks:

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E. Fill out, sign and attach Substitution Warranty Form (immediately following this document).

(Reproduce on Contractor Letterhead)

**SUBSTITUTION WARRANTY FORM**

PROJECT: \_\_\_\_\_

We \_\_\_\_\_ propose \_\_\_\_\_ to \_\_\_\_\_ provide  
\_\_\_\_\_ in lieu of,  
and as an equivalent to \_\_\_\_\_ as  
currently indicated in the Contract Documents.

We agree to assume all costs for testing, research, etc. and any modifications to other portions of the work as necessary to accommodate our material(s) and system(s) including all appurtenances required for proper installation and functioning of said material(s) and system(s) and obtaining all governing agency approvals.

We hereby warrant the \_\_\_\_\_ is the equivalent of  
\_\_\_\_\_ in every aspect and will perform satisfactorily under  
the conditions and use indicated on the Drawings and described in the Specifications.

We are hereby responsible for any costs or modifications (if any) to any other trade or portion of the project as necessary to accommodate the use of the requested substitution whether immediately apparent or discovered at a later date.

Unless indicated otherwise, in writing, there will be no delay in the Project Schedule as a result of this substitution.

Signed: \_\_\_\_\_ Date: \_\_\_\_\_  
(Manufacturer/Supplier/Other)

Signed: \_\_\_\_\_ Date: \_\_\_\_\_  
(Subcontractor)

Signed: \_\_\_\_\_ Date: \_\_\_\_\_  
(General Contractor)

END OF SECTION

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## **SECTION 01 31 00**

### **PROJECT MANAGEMENT AND COORDINATION**

#### **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.

##### **1.2 SUMMARY**

- A. Section includes administrative provisions for coordinating construction operations on Project including the following:
  - 1. Document Control Software.
  - 2. General coordination procedures.
  - 3. Administrative and supervisory personnel.
  - 4. Coordination drawings.
  - 5. RFIs.
  - 6. Project meetings.
- B. Related Requirements:
  - 1. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
  - 2. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 3. Section 01 74 19 "Construction Waste Management and Disposal" for procedures for managing construction waste materials.
  - 4. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.
  - 5. Section 01 91 00 "General Commissioning Requirements" for coordinating the Work with District's Commissioning Authority.

##### **1.3 DEFINITIONS**

- A. RFI: Request for Information. Request from Contractor seeking information required by or clarifications of the Contract Documents.
- B. District Construction Manager: District Construction Manager is General Contractor's sole point of contact for all communications with District. Direct all District communications to District Construction Manager. District Construction Manager shall

disseminate communications to appropriate District personnel as necessary.

- C. Document Control Software: The District has implemented a computerized web-accessed document management and control system for the Project referred to herein as Document Control Software. Use this system for all Project Submittals and RFI's.
- D. The District will provide Contractor personnel with access, support, and training in the use of the Document Control Software at no cost to the Contractor.
- E. The Document Control Software includes the following functions:
  - 1. Project directory;
  - 2. Project correspondence;
  - 3. Meeting minutes;
  - 4. Contract modification forms and logs;
  - 5. RFI forms and logs;
  - 6. Task and issue management;
  - 7. Photo documentation;
  - 8. Schedule and calendar management;
  - 9. Submittal forms and logs;
  - 10. Payment application forms;
  - 11. Drawing and specification document hosting, viewing, and updating;
  - 12. Online document collaboration;
  - 13. Reminder and tracking functions;
  - 14. Archiving functions.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Key Personnel Names: Within ten (10) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

#### **1.5 GENERAL COORDINATION PROCEDURES**

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.

- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
  - 1. Prepare similar memoranda for District and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities, including those of the District and separate contractors, to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include the following:
  - 1. Preparation of Contractor's construction schedule.
  - 2. Preparation of the schedule of values.
  - 3. Installation and removal of temporary facilities and controls.
  - 4. Delivery and processing of submittals.
  - 5. Progress meetings.
  - 6. Pre-installation conferences.
  - 7. Project closeout activities.
  - 8. Startup and adjustment of systems.

## **1.6 COORDINATION DRAWINGS**

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
  - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
    - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    - b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    - c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    - d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    - e. Indicate required installation sequences.
    - f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
  - 1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical

Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.

2. Plenum Space: Indicate subframing for support of ceiling[, raised access floor,] and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
  - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
  - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
  - c. Fire-rated enclosures around ductwork.
7. Electrical Work: Show the following:
  - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
  - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
  - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
  - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
8. Fire-Protection System: Show the following:
  - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
9. Review: Architect will review coordination drawings to confirm that in general the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.



## 1.7 REQUESTS FOR INFORMATION (RFIS)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, prepare and submit an RFI using the District's Document Control Software. Immediately notify the District Construction Manager, Project Inspector, District Project Manager, Architect, and Document Controls Specialist of all RFIs submitted.
  - 1. Architect will return RFIs submitted by other entities controlled by Contractor with no response.
  - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  - 1. Project name.
  - 2. RFI number, numbered sequentially (for revised RFIs, keep the original RFI number, but add an R1, R2, etc. as a suffix.)
  - 3. Date of RFI Question.
  - 4. Name of Contractor, as well as name of individual from Contractor submitting the RFI.
  - 5. Name of Architect.
  - 6. RFI subject.
  - 7. Detailed description of item needing information or interpretation.
  - 8. Specification Section number and title and related paragraphs, as appropriate.
  - 9. Drawing number and detail references, as appropriate.
  - 10. Field dimensions and conditions, as appropriate.
  - 11. Contractor's suggested resolution, if any. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  - 12. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow five (5) working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day. Incomplete RFIs or inaccurately prepared RFIs will be returned without action.
  - 1. RFIs will be returned without action if they are used for any purpose other than a request for information. Such uses include:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for approval of Contractor's means and methods.
    - d. Requests for coordination information already indicated in the Contract Documents.
    - e. Requests for adjustments in the Contract Time or the Contract Sum.
    - f. Requests for interpretation of Architect's actions on submittals.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
- D. RFI Log: The Document Control Software will generate an RFI Log. The Log will be brought to each weekly Project meeting by the District Construction Manager.

## **1.8 PROJECT MEETINGS**

- A. General: Attend all project meetings. District Construction Manager will schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: District Construction Manager will inform participants and others involved, and individuals whose presence is required, of date and time of each meeting.
  2. Minutes: District Construction Manager will record meeting results.
- B. Preconstruction Conference: District Construction Manager will schedule a preconstruction conference before starting construction, at a time convenient to District, but no later than fourteen (14) days after execution of the Notice to Proceed.
1. District Construction Manager will conduct the conference to review responsibilities and personnel assignments.
  2. Attendees: Authorized representatives of District, District's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  3. Agenda: Discuss items of significance that could affect progress. Include the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Lines of communications.
    - f. Procedures for processing field decisions and Change Orders.
    - g. Procedures for RFIs.
    - h. Procedures for testing and inspecting.
    - i. Procedures for processing Applications for Payment.
    - j. Distribution of the Contract Documents.
    - k. Submittal procedures.
    - l. Commissioning requirements and procedures.
    - m. Indoor environmental air quality management during construction.
    - n. Preparation of record documents.
    - o. Use of the premises.
    - p. Work restrictions.
    - q. Working hours.
    - r. District's occupancy requirements.
    - s. Responsibility for temporary facilities and controls.
    - t. Procedures for moisture and mold control.

- u. Procedures for disruptions and shutdowns.
  - v. Construction waste management and recycling.
  - w. Parking availability.
  - x. Office, work, and storage areas.
  - y. Equipment deliveries and priorities.
  - z. First aid.
  - aa. Security.
  - bb. Progress cleaning.
  - cc. Request for Substitution procedures.
  - dd. Use of District's Document Control Software for RFIs.
4. District Construction Manager will record meeting results and distribute them to all parties in attendance within two (2) days of meeting.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: District Construction Manager, Project Inspector, Architect, installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise all attendees of scheduled meeting dates.
  - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. Contract Documents.
    - b. Submittals
    - c. Options.
    - d. Related RFIs.
    - e. Related Change Orders.
    - f. Purchases.
    - g. Deliveries.
    - h. Review of mockups.
    - i. Possible conflicts.
    - j. Compatibility requirements.
    - k. Time schedules.
    - l. Weather limitations.
    - m. Manufacturer's written instructions.
    - n. Warranty requirements.
    - o. Compatibility of materials.
    - p. Acceptability of substrates.
    - q. Temporary facilities and controls.
    - r. Space and access limitations.
    - s. Regulations of authorities having jurisdiction.
    - t. Testing and inspecting requirements.
    - u. Installation procedures.
    - v. Coordination with other work.
    - w. Required performance results.
    - x. Protection of adjacent work.
    - y. Protection of construction and personnel.
    - z. Commissioning requirements and procedures.
    - aa. Indoor environmental air quality management during construction.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
  5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: District Construction Manager will schedule and conduct a project closeout conference, at a time convenient to District and Architect, but no later than thirty (30) days prior to the scheduled date of Substantial Completion.
1. Conference will be conducted to review requirements and responsibilities related to Project closeout.
  2. Attendees: Authorized representatives of District, District's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  3. Agenda: Discuss items of significance that could affect or delay Project closeout including the following:
    - a. Preparation of record documents.
    - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    - c. Submittal of written warranties.
    - d. Requirements for preparing operations and maintenance data.
    - e. Requirements for delivery of additional stock and spare parts.
    - f. Requirements for demonstration and training.
    - g. Commissioning requirements and procedures.
    - h. Indoor environmental air quality requirements prior to occupancy.
    - i. Preparation of Contractor's punch list.
    - j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    - k. Submittal procedures.
    - l. The District's partial occupancy requirements.
    - m. Installation of the District's furniture, fixtures, and equipment.
    - n. Responsibility for removing temporary facilities and controls.
  4. Minutes: District Construction Manager will record meeting results and distribute to all parties in attendance within two (2) days of meeting.
- E. Progress Meetings: District Construction Manager will conduct Project Progress Meetings at weekly intervals. Project Progress Meetings are in addition to specific meetings held for other purposes, such as Schedule Review Meetings.
1. Attendees: In addition to representatives of District and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: District Construction Manager will review minutes of previous progress

meeting. District Construction Manager will review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

- a. Schedule Updating: Revise Look-Ahead Schedule prior to each Progress Meeting. Send (by Email) the revised Look-Ahead Schedule to the District Construction Manager no later than 24 hours before the next Progress Meeting. The Look-Ahead Schedule shall be submitted in PDF electronic file format using computer software acceptable to District Construction Manager.
- b. Review present and future needs of each entity present including:
  - 1) Interface requirements.
  - 2) Sequence of operations.
  - 3) Status of submittals.
  - 4) Deliveries.
  - 5) Off-site fabrication.
  - 6) Access.
  - 7) Site utilization.
  - 8) Temporary facilities and controls.
  - 9) Work hours.
  - 10) Progress cleaning.
  - 11) Quality and work standards.
  - 12) Status of correction of deficient items.
  - 13) Field observations.
  - 14) Status of RFIs.
  - 15) Status of proposal requests.
  - 16) Pending changes.
  - 17) Status of Change Orders.
  - 18) Documentation of information for payment requests.
3. Minutes: District Construction Manager will record meeting results and distribute to all parties in attendance within two (2) days of the meeting.

F. Monthly Schedule Review Meetings: See Section 01 32 00 "Construction Progress Documentation."

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION - NOT USED**

### **END OF SECTION**

## **SECTION 01 32 00**

### **CONSTRUCTION PROGRESS DOCUMENTATION**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Construction bar chart schedule.
  - 2. Critical path method schedule.
  - 3. Construction photographs.
  - 4. Construction webcam.

##### **1.2 INFORMATIONAL SUBMITTALS**

- A. Construction progress schedule.
- B. Construction photographs.

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

- A. Qualifications:
  - 1. CPM Scheduler: Contractor personnel or Consultant specializing in CPM scheduling, and experienced in CPM scheduling comparable projects.
  - 2. Contractor Administrative Personnel: Three years minimum experience using and monitoring CPM schedules on comparable projects.

##### **1.4 BAR CHART PROGRESS SCHEDULE**

- A. Prepare progress schedule as a horizontal bar chart with separate bar for each major portion of Work or operation.
- B. Show complete sequence of construction by activity, with dates for beginning and completion of each construction element.
  - 1. Identify activities by Specification section number.
  - 2. Identify work of [each floor], [each area], and [logically grouped activities].
  - 3. Provide subschedules for each phase of Work identified in Section [011000].
  - 4. Provide subschedules for each Work Package.
- C. Show accumulated completion percentage of each item, and total percentage of Work completed as of the first day of each month.

- D. Submittals:
1. Submit initial progress schedule within [15] days after [Agreement] and [Notice to Proceed].
    - a. After review by [Owner] and [Architect], resubmit schedule within [10] days.
  2. Submit revised schedule with each application for payment.
  3. Distribute reviewed schedules to Project site file, Subcontractors, Suppliers, and other affected Parties.
    - a. Instruct recipients to promptly report, in writing, anticipated problems due to schedules.
  4. Upload reviewed schedules to project website. Notify affected parties.
    - a. Instruct recipients to promptly report, in writing, anticipated problems due to schedules.
  5. Show estimated percent completion for each item of Work at each submission.
  6. Provide separate schedule of submittal dates for shop drawings, product data, and samples, including [Owner furnished products] and [products furnished under allowances].
    - a. Include dates reviewed submittals are required from Architect.
    - b. Include dates for finish selections.
    - c. Include delivery dates for [Owner furnished products] and [products furnished under Allowances].
- E. Revisions: Provide narrative report to define problem areas, anticipated delays, and impact on Schedule.
1. Include activity progress and projected completion dates.
  2. Identify activities modified since previous submittal.
  3. Report actual and proposed corrective actions.
  4. Report revisions impact on other Contractors.
- F. Milestones: Include milestones specified in Contract Documents and the following:
1. Building enclosure.
  2. HVAC startup.
- G. Recovery Plan: When Work is [14] days minimum behind published schedule, submit recovery schedule.
1. Include plan for work periods, staff size, and date when recovery is complete.
- H. Distribute [copies of current schedule to Architect, Owner, and other affected entities] and [schedule by uploading to Project website].

## **1.5 CRITICAL PATH METHOD PROGRESS SCHEDULE**

- A. Prepare network analysis diagrams and supporting mathematical analyses using Critical Path Method.
- B. Format:
1. Listings: Reading from left to right, in ascending order for each activity. Identify each activity with applicable specification section number.
  2. Print Sheet Size: Maximum 36 x 48 inches.



3. Scale and Spacing: To allow for notations and revisions.
- C. Illustrate sequence and interdependence of activities and sequence of work.
  - D. Illustrate complete sequence of construction by activity, identifying work of separate [stages], [floors], and [phases]. Include legend for symbols and abbreviations used. Show the following information:
    1. Submittal dates.
    2. Submittal return dates.
    3. Long lead item procurement, delivery, and installation.
    4. Critical item procurement, delivery, and installation.
    5. Owner furnished item procurement, delivery, and installation.
    6. Testing dates.
  - E. Mathematical Analysis: Tabulate each activity on detailed network diagrams, using calendar dates, and identify for each activity:
    1. Preceding and following event numbers.
    2. Activity description.
    3. Estimated duration of activity, in maximum [15] day intervals.
    4. Earliest start date.
    5. Earliest finish date.
    6. Actual start date.
    7. Actual finish date.
    8. Latest start date.
    9. Latest finish date.
    10. Total and free float; accrue float time to Owner and to Owner benefit.
    11. Monetary value of activity, keyed to schedule of values.
    12. Percentage of activity completed.
    13. Responsibility.
  - F. Analysis Program: Capable [of compiling monetary value of completed and partially completed activities,] of accepting revised completion dates, and recomputation of scheduled dates and float.
  - G. Required Reporting: List activities in sorts or groups.
    1. Preceding Work item or event number from lowest to highest.
    2. Longest float, then in order of early start.
    3. Responsibility in earliest possible start date order.
    4. Latest allowable start dates.
    5. Latest allowable finish dates.
    6. Contractor periodic payment request sorted by [schedule of values listings] and [Specifications sections].
    7. Listing basic input data generating report.
    8. Listing activities on critical path.
  - H. Submittals: Submit to [Owner] and [Architect].
    1. Within [10] days after date [of Agreement] and [established in Notice to Proceed], submit proposed preliminary network diagram defining planned operations for first [60] days of Work, with general outline for remainder of Work.

2. Participate in reviewing preliminary and complete network diagrams jointly with [Owner] and [Architect].
  3. Within [20] days after joint review of proposed preliminary network diagram, submit draft of proposed complete network diagram. Include written certification that [major] and [mechanical and electrical] Subcontractor have reviewed and accepted proposed schedule.
  4. Within [10] days after joint review, submit complete network analysis consisting of network diagrams and mathematical analysis.
  5. Submit updated network schedules as follows:
    - a. With each Application for Payment.
    - b. Every [14], [30], and [60] days.
- I. Review and Evaluation:
1. Participate in joint review and evaluation of network diagrams and analysis with [Owner] and [Architect] at each submittal.
  2. Evaluate Project status to determine work behind schedule and work ahead of schedule.
  3. After review, revise network diagrams and analysis incorporating results of review, and resubmit within [10] days.
- J. Updating Schedule:
1. Maintain schedules; record completed activities actual start and finish dates.
  2. Include activity progress to date of revision, with projected activity completion date. [Annotate] and [Update] diagrams to graphically depict current Work status.
  3. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
  4. Include changes required to maintain Date of [Substantial] and [Final] Completion.
  5. Submit sorts required to support recommended changes.
  6. Prepare narrative report defining problem areas, anticipated delays, and impact on schedule. Report corrective action taken or proposed and its effect [including effects of changes on schedules of separate contractors].
- K. Distribution:
1. Following joint review, distribute copies of updated schedules to Contractor Project site file, to Architect and Owner.
  2. Following joint review, upload updated schedules to Project website.
  3. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

## **1.6 CONSTRUCTION PHOTOGRAPHS**

- A. Employ professional photographer or Assign a member of Contractor staff to take construction record photographs during construction.
- B. Digital Camera: Sensor resolution of 10 megapixels minimum.

- C. Format: 3200 by 2400 pixels minimum, in unaltered original JPEG or TIFF files, uncropped, date and time stamp , saved in folder named by date of photographs.
  - 1. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimal distortion.
- D. Required Photographs:
  - 1. Two aerial photographs of site at beginning and completion of Work.
  - 2. Existing conditions that might be misconstrued as damage from construction activities.
  - 3. Take photographs monthly to record general progress at time of application for payment.
  - 4. Mockups, Field Samples: Photograph each step of installation to record concealed conditions.
  - 5. Accidents and damage to construction in process.
- E. Transmit electronic photograph files to Owner and Architect contemporaneously with monthly applications for payment.
  - 1. Include list of photographs indication location and direction of view.
- F. After transmittal, Owner and Architect may make prints or use the photograph files without limitation.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION - NOT USED**

### **END OF SECTION**

**SECTION 01 33 00**  
**SUBMITTAL PROCEDURES**

**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.

**1.2 SUMMARY**

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
  - 1. Section 01 31 00 "Project Management and Coordination" for use of District's Document Control Software.
  - 2. Section 01 31 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
  - 3. Section 01 40 00 "Quality Requirements" for submitting quality control schedules and reports.
  - 4. Section 01 77 00 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
  - 5. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 6. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 7. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of District's personnel.

**1.3 DEFINITIONS**

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

- C. Document Control Software: The District has implemented a computerized web-accessed document management and control system for the Project referred to herein as "Document Control Software." Use this system for all Project Submittals unless noted otherwise.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

#### **1.4 SUBMITTAL SCHEDULE**

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect or District and additional time for handling and reviewing submittals required by those corrections.
  - 1. Coordinate submittal schedule with Contractor's construction schedule.
  - 2. Initial Submittal: Submit concurrently with Baseline Schedule.
  - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
  - 4. Format: Arrange the following information in a tabular format:
    - a. Scheduled date for first submittal.
    - b. Specification Section number and title.
    - c. Submittal category: Action; informational.
    - d. Name of subcontractor.
    - e. Description of the Work covered.
    - f. Scheduled date for Architect's final release or approval.
    - g. Scheduled date of fabrication.
    - h. Scheduled dates for purchasing.
    - i. Scheduled dates for installation.
    - j. Activity or event number.

#### **1.5 SUBMITTAL FORMATS**

- A. Architect's Digital Data Files:
  - 1. Architect will furnish Contractor individual plans or sheets of digital data drawing files of the Contract Drawings as required for use in preparing Shop Drawings.
    - a. Digital data drawings files will only be made available with Contractor's signed acceptance of Architect's electronic files/documents hold harmless use disclaimer.
    - b. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other

- submittals, and related activities that require sequential activity.
- 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
- 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
- 4. Coordinate transmittal timing of submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.
  - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  - 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  - 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
  - 4.
  - 5. DSA review: Where submittal must be reviewed by DSA, allow 35 days for review of submittal.
- D. Options: Identify options requiring selection by Architect. Make all submittals electronically using District's Document Control Software.
- E. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations.
- F. Electronic Submittals: Provide submittals using District's Document Control Software. Immediately notify Architect, District Construction Manager, Project Inspector, and Document Control Specialist of all submittals made.
- G. Resubmittals: Make resubmittals in same manner as initial submittal.
  - 1. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Furnish one copy of each final action submittal marked with approval notation from Architect's action stamp to Project Inspector.
- J. Use for Construction: Retain complete copies of submittals on Project site. Use only

final action submittals that are marked with approval notation from Architect's action stamp.

## **1.6 SUBMITTAL PROCEDURES**

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
  - 1. Post electronic submittals as PDF electronic files directly to Document Control Software.
    - a. Architect will post annotated file and notify Contractor of posting.
  - 2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Provide certificates and certifications signed by an officer or other individual authorized to sign documents on behalf of that entity.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
  - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
  - 2. Mark each copy of each submittal to show which products and options are applicable.
  - 3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Standard color charts.
    - d. Statement of compliance with specified referenced standards.
    - e. Testing by recognized testing agency.
    - f. Application of testing agency labels and seals.
    - g. Notation of coordination requirements.
    - h. Availability and delivery time information.
  - 4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams showing factory-installed wiring.
    - b. Printed performance curves.
    - c. Operational range diagrams.
    - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
  - 5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.
  - 6. Submit Product Data in the following format:
    - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
  - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

- a. Identification of products.
  - b. Schedules.
  - c. Compliance with specified standards.
  - d. Notation of coordination requirements.
  - e. Notation of dimensions established by field measurement.
  - f. Relationship and attachment to adjoining construction clearly indicated.
  - g. Seal and signature of professional engineer if specified.
- 2. Prepare Shop Drawings on same digital data software program, version, and operating system as original Drawings
- 3. Submit Shop Drawings in the following format:
  - a. PDF electronic file.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
  - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  - 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
    - a. Project name and submittal number.
    - b. Generic description of Sample.
    - c. Product name and name of manufacturer.
    - d. Sample source.
    - e. Number and title of applicable Specification Section.
    - f. Specification paragraph number and generic name of each item.
  - 3. Provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
  - 4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    - b. Samples not incorporated into the Work, or otherwise designated as District's property, are the property of Contractor.
  - 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    - a. Number of Samples: Submit two full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return one submittal with options selected.
  - 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and



components used for independent testing and inspection.

- a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
  - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
  - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
  1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
  2. Manufacturer and product name, and model number if applicable.
  3. Number and name of room or space.
  4. Location within room or space.
  5. Submit product schedule in the following format:
    - a. PDF electronic file.
- F. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- G. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- H. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- I. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- J. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- K. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- L. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

- M. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- N. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
  - 1. Name of evaluation organization.
  - 2. Date of evaluation.
  - 3. Time period when report is in effect.
  - 4. Product and manufacturers' names.
  - 5. Description of product.
  - 6. Test procedures and results.
  - 7. Limitations of use.
- O. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- P. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- Q. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- R. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of applicable codes and regulations, and calculations, list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

## **1.7 DELEGATED-DESIGN SERVICES**

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
- C. BIM Incorporation: Incorporate delegated-design drawing and data files into Building Information Model established for Project.
  - 1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

## **1.8 CONTRACTOR'S REVIEW**

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
  - 1. Architect will not review submittals that do not have Contractor's review and approval.

## **1.9 ARCHITECT'S REVIEW**

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and post review on Document Control Software. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
  - 1. No Exceptions Noted.<Insert description of each action indicated on Architect's stamp>.
  - 2. Make Corrections Noted.
  - 3. Submit Specified Item.
  - 4. Revise and Resubmit.
  - 5. Rejected.
  - 6. Reviewed for Information Only
- B. Informational Submittals: Architect will review each submittal and will post submittal review on Document Control Software only if it does not comply with requirements.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals received from sources other than Contractor will be returned by the Architect without action or may be discarded.
- F. Submittals not required by the Contract Documents will be returned by the Architect without action or may be discarded.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 40 00**  
**QUALITY REQUIREMENTS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Quality Assurance.
  - 2. Quality control and control of installation.
  - 3. Delegated design services.
  - 4. Tolerances.
  - 5. References.
  - 6. Labeling.
  - 7. Mockups.
  - 8. Field samples.
  - 9. Testing and inspecting services.
  - 10. Manufacturer field services.
  - 11. Test reports and certifications.

**1.2 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Manufacturers: Experienced firms with sufficient production capacity to produce units required.
  - 2. Fabricators and Finish Applicators: Experienced firms with sufficient production capacity to produce units required.
  - 3. Installers: Experienced firms or individuals with sufficient manpower to produce Work required.
  - 4. Testing Agencies: Experienced firms with sufficient capacity and necessary equipment to perform tests required, following one of the following programs.
    - a. A nationally recognized testing laboratory per 29 CFR 1910.7.
    - b. Accredited agency per NIST National Voluntary Laboratory Accreditation Program.
  - 5. Licensed Professionals: Experienced individuals, licensed or otherwise legally qualified to practice in the jurisdiction where the Project is located.

**1.3 QUALITY CONTROL AND CONTROL OF INSTALLATION**

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Follow specified reference standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements include higher standards

or more precise workmanship.

- C. Measure in place construction as needed for fabrication and execution. No changes to Contract Sum or Contract Time will be allowed for differences between Drawing dimensions and field measurements where no measurements were performed.

#### **1.4 DELEGATED DESIGN SERVICES**

- A. Where delegated design is specified, follow specified performance and design criteria.
  - 1. If criteria are not sufficient, submit RFI for needed criteria.

#### **1.5 TOLERANCES**

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Follow manufacturer tolerances. When manufacturer tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

#### **1.6 REFERENCE STANDARDS**

- A. Abbreviations and Acronyms: Names of trade associations, standards generating organizations, governing authorities, and other entities are frequently referred to in Contract Documents by acronyms and abbreviations. Request explanation of unknown terms from Architect.
- B. For products or workmanship specified by association, trade, or other consensus standards, follow requirements of standard, except when more rigid requirements are specified or are required by applicable codes.
- C. Follow reference standards by date of issue current on date of Contract Documents, except where specific edition date is required by code.
- D. Where specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- E. Provisions within cited reference standards changing Owner, Architect, and Contractor duties and responsibilities from contractual requirements are void.

## **1.7 LABELING**

- A. Attach labels from agencies approved by authority having jurisdiction for products, assemblies, and systems required to be labeled by applicable code.
- B. Label Information: Include approved agency identification on each label. Install products with labels visible. Include:
  - 1. Manufacturer name.
  - 2. Model number.
  - 3. Serial number.
  - 4. Performance characteristics.

## **1.8 MOCKUPS**

- A. Definition:
  - 1. Mockups are constructed to demonstrate materials and workmanship for review by Architect and Owner.
- B. Construct mockups at Project site in locations acceptable to Architect unless laboratory mockups are specified.
- C. Construct mockups in compliance with applicable Specification sections.
  - 1. Design and construct foundations, supports, framing, and bracing for freestanding mockups.
- D. Photograph construction to record concealed conditions per requirements of Section 013200. Make photographs available to Architect and Owner when requested.
- E. Mockups are subject to testing specified for constituent products.
- F. Approved mockups establish work results standard.
- G. Protect mockups against damage until removal is authorized.
- H. Mockups may remain as part of the Work only when so designated in individual Specification sections.

## **1.9 FIELD SAMPLES**

- A. Definition:
  - 1. Field samples are assemblies constructed to demonstrate materials and workmanship for review by Architect and Owner.
    - a. Construct field samples in final locations in sizes described in technical Specifications sections.
- B. Construct field samples in compliance with applicable Specification sections.
- C. Approved field samples establish Work results standard.

- D. Protect field samples against damage until Substantial Completion.
- E. Approved, undamaged field samples may remain as part of the Work unless designated in individual Specification sections.

#### **1.10 TESTING AND INSPECTION SERVICES**

- A. Except where specified as Owner responsibility, employ and pay for specified services of an independent firm to perform testing and inspections.
  - 1. Owner testing and inspecting agencies will be identified to Contractor.
  - 2. Copies of reports prepared by Owner testing and inspecting agencies will be sent to Contractor.
- B. Include dates for agency testing and inspecting in Progress Schedule and provide minimum 10 days prior notice to agencies.
  - 1. Provide access to the Work as requested by testing and inspecting agencies.
  - 2. Provide samples of materials, design mixes, equipment, tools, storage for Samples, and assistance by incidental labor requested by agency.
- C. Inspection Requests: Make inspection requests in writing to Inspector of Record and District Construction Manager 72 hours in advance of planned Work.
- D. Testing and employment of testing and inspecting agencies shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- E. Retest and reinspect defective work when required by Architect.
  - 1. Failed Test Retest Cost: Contractor responsibility.
- F. Limits on testing and inspecting agencies:
  - 1. Agency does not have authority to release, revoke, alter, or enlarge on requirements of Contract Documents.
  - 2. Agency does not have authority to approve or accept any portion of Work.
  - 3. Agency may not assume duties of Contractor.
  - 4. Agency does not have authority to stop Work.

#### **1.11 MANUFACTURER FIELD SERVICES**

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe and provide instructions when necessary for acceptable:
  - 1. Installation conditions.
  - 2. Workmanship quality.
  - 3. Equipment startup.
  - 4. Equipment test, adjust, and balance.
- B. Submit qualifications of observer to Architect 14 days, minimum, in advance of required observations.



- C. Report observations and site decisions or instructions that are supplemental or contrary to Contract Documents or manufacturers written instructions.
- D. Submit written inspection reports per Section 013300.

#### **1.12 TEST REPORTS AND CERTIFICATIONS**

- A. When specified in individual Specification sections, require material or Product suppliers or manufacturers to provide test reports and manufacturer certifications.
- B. Show that material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Submittals may be recent or previous test results on material or Product, as acceptable to Architect.
- D. Submit reports and certifications per Section 013300.

#### **PART 2 PRODUCTS - NOT USED**

#### **PART 3 EXECUTION - NOT USED**

#### **END OF SECTION**

## **SECTION 01 42 00**

### **REFERENCES**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

##### **1.2 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.

##### **1.3 DEFINITIONS**

- A. General: Basic Contract definitions are included in the General Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the General Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete in place and ready for the intended use.
- I. "City": City of Shafter, unless specified otherwise.
- J. "Includes", "Including", and variations thereof: "Includes, but not limited to,..."

## **1.4 INDUSTRY STANDARDS**

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.
- D. Sources for complete titles of individual Industry Standards:
  - 1. Internet search engines
  - 2. United Master Reference List (UMRL) at <https://www.wbdg.org/FFC/DOD/UMRL/UMRL.pdf>.

## **1.5 ABBREVIATIONS AND ACRONYMS**

- A. Abbreviations and acronyms are to mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States." For abbreviations and acronyms not included in these references, use internet search engine according to appropriate context and subject matter.
- B. Industry Organizations, Code Agencies, Federal and State Government Agencies, Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities.
- C. Where duplicates occur, use according to appropriate context and subject matter.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION - NOT USED**

## **END OF SECTION**

## **SECTION 01 50 00**

### **TEMPORARY FACILITIES AND CONTROLS**

#### **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.

##### **1.2 SUMMARY**

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
  - 1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.
  - 2. Section 32 13 13 "Sitework Concrete" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.
  - 3. Section 32 80 00 "Irrigation"

##### **1.3 USE CHARGES**

- A. General: Installation, removal of, maintenance, cleaning, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in project to use temporary services and facilities without cost, including District, Architect, testing agencies, and authorities having jurisdiction.
  - 1. Water Service: Pay water-service use charges for water used by all entities for construction operations.
  - 2. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.
- B. District's existing water system and electric power are available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations. Allow other entities to use temporary services and facilities without cost, including District, Architect, testing agencies, and authorities having jurisdiction.

##### **1.4 SUBMITTALS**

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and

connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

- B. Storm Water Pollution Prevention Plan: Provide Storm Water Pollution Prevention Plan per Section 01 57 23 "Temporary Storm Water Pollution Control".
- C. Project Identification and Temporary Signs: Show materials, fabrication, fasteners, attachment methods, and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.
- D. Moisture-Protection Plan as specified herein.
- E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
  - 1. Locations of dust-control partitions at each phase of work.
  - 2. HVAC system isolation schematic drawing.
  - 3. Location of proposed air-filtration system discharge.
  - 4. Waste handling procedures.
  - 5. Other dust-control measures.

## **1.5 QUALITY ASSURANCE**

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Moisture-Protection: Protect materials and construction from water absorption and damage. Protect during delivery, handling, and storage. Discard water-damaged materials, mitigate water intrusion into completed Work, and replace water damaged Work.
- C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- D. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and CBC.

## **1.6 PROJECT CONDITIONS**

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before District's acceptance, regardless of previously assigned responsibilities.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 8 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts. Securely embed fence posts into ground to avoid fence turnover.
  - 1. Provide securely fastened continuous screening fabric on portable chain link fence.
- B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- C. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

### **2.2 TEMPORARY FACILITIES**

- A. All field offices and sanitary facilities must comply with applicable codes and regulations, including disabled accessibility regulations.
- B. District Field Offices:
  - 1. Field Office:
    - a.
    - b. The field office, its toilet rooms and its equipment are for the District's exclusive use.
    - c. Provide a 24' x 44' double wide trailer for use by the Project Inspector, District Construction Manager, Controls Personnel and other District personnel.
    - d. Provide meters for all utilities.
    - e. Provide a UFER ground, 5/8" x 8' ground rod connected to the ground buss in the field office electrical panel with a #6 solid CU conductor.
    - f. The trailer shall contain two (2) 10' x 12' and two (2) 10' x 8' private offices with locking doors, one 5' x 5' utility room with sink, and one (1) 20' x 15' conference room.
    - g. The field office shall be installed and completely furnished within two weeks of the Notice to Proceed. This field office must remain on site during the entire Project and cannot be removed without prior written authorization from the District. It shall remain fully operational until Final Completion.
    - h. The trailer layout and location shall be approved by the District Construction Manager.
    - i. This office shall be of substantial waterproof construction, heated, air-conditioned, with adequate natural light and ventilation, tied down, and resting on temporary foundations adequate for normal office loading.
    - j. Provide and mount a 2' x 4' sign titled "San Diego Unified School District

- Construction Office” and containing the proposition logos. District will provide.jpg and.png format files for proposition logos.
- k. The windows shall be operable, tinted on the exterior, and equipped with window blinds.
  - l. The exterior door shall have access to the outside with landings, stairs, a key-type lock, and a deadbolt key lock.
  - m. Both the window and door glass shall be protected with security bars.
  - n. Notify the Project Inspector forty-eight (48) hours prior to the date of hook-up of temporary utilities.
  - o. All facilities described here shall be either in a new or like new condition and shall remain the property of the Contractor. If the facilities are not new, the facilities shall be in a condition acceptable to the District.
  - p. Service, repair and maintain facilities (including utilities, garbage and cleaning services) in good working order.
2. Toilet Rooms:
- a. The field office shall have two (2) toilet rooms with toilet accessories as required by applicable law.
  - b. Each toilet room shall have a locking door and be equipped with a water closet with tank (also with toilet tissue dispenser, toilet seat cover dispenser) and a lavatory with hot and cold water service, soap dispenser, and hand-towel dispenser.
  - c. Maintain the toilet rooms in a neat, clean, and orderly manner, and refill all consumables semi-monthly.
3. Equipment:
- a. Provide six (6) 30” x 60” office desks, five (5) tables satisfactory for the study of plans, two (2) vertical plan racks and (10) sticks, six (6) desk chairs with wheels and arms, and sixteen (24) standard chairs, two (2) 4’ x 10’ conference tables, two (2) legal size horizontal type lockable 6-drawer and three (3) legal size horizontal type lockable 2-drawer filing cabinets with keys, one (1) large and six (6) small bookshelves, one (1) utility supply cabinet, seven (7) waste paper receptacles, three (3) private telephone lines, two (2) telephone answering devices, adequate electric lights, and bottled drinking water dispenser with paper cups.
  - b. Contractor shall provide seven (7) hands free speaker type telephones distributed as follows: one in each office, one in the conference room and remaining jacks/phones located at the District Construction Manager’s direction.
  - c. Service and supply one (1) multifunction color printer/scanner/fax/copier (Canon Advance C33301 with AL-1, G-1 or equal). Multifunction printer shall scan in color. Multifunction printer shall print/copy/scan paper sizes of 8½ x11, 8½ x14 and 11x 17. Provide a service plan and supplies including paper and toner for multifunction printer.
  - d. Provide DSL/cable service to the field office (or high speed wireless if DSL is not available). The field office shall allow for eight (8) District computers and printers. The Ethernet jacks shall be distributed as follows: one (1) in each office, two (2) in the conference room, and one (1) in common area for multifunction printer. Provide DSL/cable connection and necessary hardware for a minimum of six (6) District computers to simultaneously access the Internet and for users to login to District’s VPN to utilize District resources.

The District's DSL/cable service shall be separate from the Contractor's jobsite network. The DSL/cable service provided by the Contractor shall have the minimum connection speed of a 40 Mbps downstream, 4 Mbps upstream and have a static IP address for the sole and exclusive use by the District.

- e. Provide six (6) parking spaces dedicated for District use adjacent to the field office.
  - f. All equipment and furnishings described here shall be provided in either a new or like-new condition and shall remain the property of the Contractor. If equipment is not new, the equipment shall be in a condition acceptable to the District.
  - g. Re-supply, service, repair and maintain equipment in good working order, including paper and inks/toner.
- C. Contractor's Field Office and Sanitary Facilities:
- 1. The Contractor's Field Office: Equip with lockable entrances, operable windows and serviceable finishes, and heating and ventilation on foundations adequate for normal loading. Provide adequate space for a conference table with sufficient seating for ten (10) people. Provide the sanitary facilities, wash facilities and drinking water as required by applicable codes and regulations.
- D. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations. Store combustible materials away from building(s).
- E. Project Identification Sign
- 1. Wood: Plywood and support frame per section 06 10 00 "Rough Carpentry". Paint all sides and edges of wooden sign per section 09 91 13 "Exterior Painting".
  - 2. Size, Graphics, Location, Substrate: As shown on drawings.
- F. Temporary Signs
- 1. Provide signs as indicated and as required to inform and protect public and individuals seeking entrance to Project.
  - 2. Provide temporary, directional and caution signs for construction personnel and visitors.

## **2.3 EQUIPMENT**

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless District authorizes use of existing permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
- 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified



testing agency and marked for intended location and application.

- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

## **PART 3 EXECUTION**

### **3.1 TEMPORARY FACILITIES, GENERAL**

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- C. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

### **3.2 TEMPORARY UTILITY INSTALLATION**

- A. General: Install temporary service.
  - 1. Arrange with utility company, District, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- C. Water Service: Connect to District's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to District. At Substantial Completion, restore these facilities to condition existing before initial use.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

- F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas. Isolate work area from occupied areas of building.
  - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
    - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
    - b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
  - 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
  - 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
  - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
  - 1. Install electric power service overhead unless otherwise indicated.
- I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
  - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

### **3.3 SUPPORT FACILITIES INSTALLATION**

- A. General: Comply with the following:
  - 1. Provide construction for temporary offices, shops, and sheds located within construction area.
  - 2. Maintain support facilities until Substantial Completion.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations.
  - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

- C. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
  - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
  - 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 31 20 00 "Earth Moving."
  - 3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
  - 4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 32 12 16 "Asphalt Paving."
- D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
  - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
  - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- E. Parking: Use designated areas of District's existing parking areas for construction personnel.
- F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
  - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
- G. Project Signs: Provide construction for project signs as indicated. Unauthorized signs are not permitted. Maintain and touch up signs so they are legible at all times.
- H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution." Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."
- I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
  - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- J. Existing Elevator Use: Use of District's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to District. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
  - 1. Do not load elevators beyond their rated weight capacity.
  - 2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection,

elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

- K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- L. Existing Stair Usage: Use of District's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to District. At Substantial Completion, restore stairs to condition existing before initial use.
  - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

### **3.4 TREE, PLANT, AND IRRIGATION SYSTEM PROTECTION**

- A. Take all measures necessary to protect existing trees, plants and irrigation that is to remain. Measures include, without limitation, substantial barricades to prevent damage. Maintain existing plant materials within the area of Work that are to remain, including periodic watering, trimming, and weeding. Install temporary fencing located to protect vegetation and irrigation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- B. Inspect the irrigation system with the Project Inspector to determine existing conditions prior to commencement of Work. Repair, replace, or correct damage to existing irrigation system and plant materials caused by Contractor operations without adjustment to the Contract Time or the Contract Price. The repair, replacement, or correction of existing plant materials and irrigation system shall bring both to their original condition prior to construction, as determined by the Project Inspector.
- C. Ensure existing irrigation systems are operable during selective demolition. Provide temporary power to controller. Provide temporary water source to existing mainline within and outside of project limits as required to maintain an operable system during demolition and construction. If temporary power and/or water is unavailable, hand water existing plant materials within and outside of project limits until automatic system is restored.
- D. Provide a qualified arborist who shall certify that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- E. Temporary Fencing: Install temporary fencing located as indicated or outside the drip line of trees to protect remaining vegetation from construction damage.
  - 1. Install chain link fence according to ASTM F 567 and manufacturer's written instructions.
- F. Protect tree root systems from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials. Protect root systems

from flooding, eroding, or excessive wetting caused by dewatering operations.

- G. Do not store construction materials, debris, or excavated material within the drip line of remaining trees. Do not permit vehicles or foot traffic within the drip line; prevent soil compaction over root system.

### **3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION**

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
  - 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain prior written permission from the District.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for District. Perform control operations lawfully, using environmentally safe materials approved by authorities having jurisdiction.
- D. Site Enclosure Fence: Before construction operations begin, provide site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
  - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
  - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.
- E. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
  - 1. Provide and maintain temporary barricades at all hazardous areas to protect both pedestrians and vehicles at all times. This protection shall be for students, faculty and all others at both offsite and onsite work. Adjust and relocate barricades as necessary for protection as work progresses to different locations. Areas that require barricades include such things as trenches, changes to sidewalks/driveways and projections above ground.

- G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
  - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- H. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
  - 1. Prohibit smoking on District property.
  - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
  - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

### **3.6 MOISTURE AND MOLD CONTROL**

- A. Contractor's Moisture-Protection Plan: Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
  - 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
  - 2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
  - 3. Avoid trapping water in finished work. Indicate methods to be used to avoid trapping water in finished work.
  - 4. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
  - 1. Protect porous materials from water damage.
  - 2. Protect stored and installed material from flowing or standing water.
  - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
  - 4. Remove standing water from decks.
  - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
  - 1. Do not load or install drywall or other porous materials or components, or items

- with high organic content, into partially enclosed building.
  - 2. Keep interior spaces reasonably clean and protected from water damage.
  - 3. Periodically collect and remove waste containing cellulose or other organic matter.
  - 4. Discard or replace water-damaged material.
  - 5. Do not install material that is wet.
  - 6. Discard, replace, or clean stored or installed material that begins to grow mold.
  - 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
- 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
  - 2. Use permanent HVAC system to control humidity.
  - 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
    - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
    - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to the District Construction Manager.
    - c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

### **3.7 OPERATION, TERMINATION, AND REMOVAL**

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
  - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. District reserves right to take possession of Project identification signs.
  2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, a
  3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

#### **END OF SECTION**



## **SECTION 01 60 00**

### **PRODUCT REQUIREMENTS**

#### **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.

##### **1.2 SUMMARY**

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and "or equal" products.
- B. Related Requirements:
  - 1. Section 01 21 00 "Allowances" for products selected under an allowance.
  - 2. Section 01 23 00 "Alternates" for products selected under an alternate.
  - 3. Section 01 25 00 "Substitution Procedures" for requests for substitutions.
  - 4. Section 01 42 00 "References" for applicable industry standards for products specified.

##### **1.3 DEFINITIONS**

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
  - 3. "or equal" Product: Product that is demonstrated and approved through the substitution request process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be

listed to establish significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating “or equal” products of additional manufacturers.

#### **1.4 QUALITY ASSURANCE**

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

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

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
  - 1. Store products to allow for inspection and measurement of quantity or counting of units.
  - 2. Store materials in a manner that will not endanger Project structure.
  - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
  - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
  - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
  - 6. Protect stored products from damage and liquids from freezing.

## **1.6 PRODUCT WARRANTIES**

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to District.
  - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for District.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
  - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
  - 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

## **PART 2 PRODUCTS**

### **2.1 PRODUCTS NOT ALLOWED**

- A. Do not provide products that contain asbestos, lead, or coal tar.

### **2.2 PRODUCT SELECTION PROCEDURES**

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
  - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  - 3. District reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  - 4. Where products are accompanied by the term "as selected," Architect will make selection.
  - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
  - 6. For products specified by name and accompanied by the term "or equal," comply with requirements of Section 01 25 00 "Substitution Procedures" to obtain approval for use of an unnamed product.

- B. Product Selection Procedures:
1. Where Specifications name a single manufacture's product and indicate "no substitution", provide the named product that complies with requirements. "or equal" products (substitutions) will not be considered.
  2. Where Specifications name a single manufacturer or source and indicate "no substitution", provide a product by the named manufacturer or source that complies with requirements. "or equal" products (substitutions) will not be considered.
  3. Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. "or equal" products (substitutions) will be considered.
  4. Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. "or equal" products (substitutions) will be considered unless expressly specified otherwise.
  5. Basis-of-Design Product: Where Specifications name a product as the basis-of-design product, or refer to a product indicated on Drawings as the basis-of-design product, provide the specified or indicated product. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. "or equal" products (substitutions) will be considered.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select features such as color, gloss, pattern, density, texture from manufacturer's product line.

## **PART 3 EXECUTION**

### **3.1 COLOR CONSISTENCY**

- A. All like finish products within a given visible area shall be from the same dye lot or color run.
- B. If like finish products within a given visible area vary slightly in color, mix and blend varying colors to avoid distinct areas of color variation.

## **END OF SECTION**

## **SECTION 01 73 00**

### **EXECUTION**

#### **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.

##### **1.2 SUMMARY**

- A. Section includes general administrative and procedural requirements governing execution of the Work, including the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. Installation of the Work.
  - 4. Cutting and patching.
  - 5. Coordination of District-installed products.
  - 6. Progress cleaning.
  - 7. Starting and adjusting.
  - 8. Protection of installed construction.
  - 9. Correction of the Work.
- B. Related Requirements:
  - 1. Section 01 10 00 "Summary" for limits on use of Project site.
  - 2. Section 01 33 00 "Submittal Procedures" for submitting surveys.
  - 3. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of District-accepted deviations from indicated lines and levels, and final cleaning.

##### **1.3 DEFINITIONS**

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

##### **1.4 ACTION SUBMITTALS**

- A. Cutting and Patching Request
  - 1. Submit Cutting and Patching Plan describing procedures at least 10 days prior to

- the time cutting and patching will be performed.
2. Include the following information:
    - a. Extent: Describe reason for and extent of each occurrence of cutting and patching.
    - b. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
    - c. Products: List products to be used for patching, including product data and patching details, and firms or entities that will perform patching work.
    - d. Dates: Indicate when cutting and patching will be performed.
    - e. Contractor's stamp, Contractor's name, Project location and name, Contractor's signature acknowledging review of Cutting and Patching Request, including Cutting and Patching Plan.
    - f. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
      - 1) Include description of provisions for temporary services and systems during interruption of permanent services and systems.
  3. Obtain District Construction Manager's approval prior to commencing cutting and patching work. Approval does not waive District's right to require removal and replacement of unsatisfactory cutting and patching work.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For land surveyor.
- B. Qualification Data: For franchise utility project manager.
- C. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- D. Landfill Receipts: Submit copies of waste hauler slips indicating the amount of waste hauled in tons and the amount of waste in tons diverted from landfill and recycled, composted or salvaged.
- E. Certified Surveys: Submit two copies signed by land surveyor.
- F. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

## **1.6 QUALITY ASSURANCE**

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in California and who is experienced in providing land-surveying services of the kind indicated.
- B. Franchise Utility Project Manager Qualifications: A qualified franchise utility project

manager/coordinator with a minimum of 10 years' experience in project management with utility agencies (SDG&E, SBC Global, Cox Cable, Time Warner, etc.). Duties shall include administering and coordinating all aspects of the administration of the franchise utility work including contractor self-performed work.

- C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
  - 1. Structural Elements: When cutting and patching structural elements, notify the District Construction Manager of locations and details of cutting, and await directions from the District Construction Manager before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
  - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
    - a. Primary operational systems and equipment.
    - b. Fire separation assemblies.
    - c. Air or smoke barriers.
    - d. Fire-suppression systems.
    - e. Plumbing piping systems.
    - f. Mechanical systems piping and ducts.
    - g. Control systems.
    - h. Communication systems.
    - i. Fire-detection and -alarm systems.
    - j. Conveying systems.
    - k. Electrical wiring systems.
    - l. Operating systems of special construction.
    - m. Weather barriers.
    - n. Thermal protection systems, including insulation assemblies.
  - 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include the following:
    - a. Water, moisture, or vapor barriers.
    - b. Membranes and flashings.
    - c. Exterior curtain-wall construction.
    - d. Sprayed fire-resistive material.
    - e. Equipment supports.
    - f. Piping, ductwork, vessels, and equipment.
    - g. Noise- and vibration-control elements and systems.
  - 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in the District Construction Manager's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's

written recommendations and instructions for installation of products and equipment.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.
  - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
  - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site to District Construction Manager 10 days prior to start of work.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine surfaces, substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
  - 1. Description of the Work.
  - 2. List of detrimental conditions, including substrates.
  - 3. List of unacceptable installation tolerances.
  - 4. Recommended corrections.



- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### **3.2 PREPARATION**

- A. Existing Utility Information: Furnish information to local utility and District Construction Manager that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 31 00 "Project Management and Coordination."

### **3.3 CONSTRUCTION LAYOUT**

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify the District Construction Manager promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
  - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 2. Establish limits on use of Project site.
  - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 4. Inform installers of lines and levels to which they must comply.
  - 5. Check the location, level and plumb, of every major element as the Work progresses.
  - 6. Notify the District Construction Manager when deviations from required lines and levels exceed allowable tolerances.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for

mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and project Inspector.

### **3.4 FIELD ENGINEERING**

- A. Reference Points: Locate existing permanent benchmarks, survey monuments, temporary control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and survey monuments during construction operations.
  - 1. If any existing permanent benchmark will be destroyed as a result of construction, notify District Construction Manager in writing before such destruction occurs. Do not disturb benchmark until City forces have established necessary control to set a new permanent benchmark and District Construction Manager has given written permission to proceed.
  - 2. If any survey monument will be destroyed as a result of construction, before such destruction occurs, notify District Construction Manager in writing. Engage a Land Surveyor to survey as necessary and prepare Pre-construction Corner Record complying with the California Professional Land Surveyors Act. Section 8771. File Pre-construction Corner Record with San Diego County Surveyor. Send a copy of preliminary Corner Record to District Construction Manager. Do not disturb survey monument until Pre-construction Corner Record is received and accepted by County and written permission is obtained from District Construction Manager. After lost monument has been replaced, engage a Land Surveyor to file a final Corner Record (or a Record of Survey if required) with San Diego County Surveyor.
- B. Benchmarks: Establish and maintain a minimum of two temporary benchmarks on Project site, referenced to data established by survey control points.
  - 1. Record temporary benchmark locations, with horizontal and vertical data, on Project Record Drawings.
  - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
  - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

### **3.5 INSTALLATION**

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by the District Construction Manager.
  - 2. Allow for building movement, including thermal expansion and contraction.
  - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use only products, cleaners, and installation materials that are not considered hazardous.
- K. Underground Detectable Warning Tapes: Ensure that completed work provides fully functional underground detectable warning tapes per requirements specified in other Sections.

### 3.6 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces and assemblies to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials, assemblies, and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00 "Summary."
- F. Existing Utility Services: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize and prevent interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping.
  - 2. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Cut or form holes for penetrations accurately to allow for proper sealing. Temporarily cover openings when not in use.
  - 3. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - 4. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - 5. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  - 6. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  - 7. Proceed with patching after construction operations requiring cutting are complete.
- H. Notify District Construction Manager 48 hours prior to closing openings. Allow Inspector to view conditions prior to closing.

- I. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
  - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
  - 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance. Replace ceiling tiles damaged by cutting and patching work.
  - 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- J. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### **3.7 DISTRICT-INSTALLED PRODUCTS**

- A. Site Access: Provide access to Project site for District's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by District's construction personnel.
  - 1. Construction Schedule: Inform District of Contractor's preferred construction schedule for District's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify District if changes to schedule are required due to differences in actual construction progress.
  - 2. Preinstallation Conferences: Include District's construction personnel at preinstallation conferences covering portions of the Work that are to receive District's work. Attend preinstallation conferences conducted by District's construction personnel if portions of the Work depend on District's construction.

### 3.8 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
  - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
  - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers intended for holding waste materials of type to be stored.
  - 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  - 1. Remove liquid spills promptly.
  - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 50 00 "Temporary Facilities and Controls." and Section 01 74 19 "Construction Waste Management and Disposal."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the

construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### **3.9 STARTING AND ADJUSTING**

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 01 91 13 "General Commissioning Requirements."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 02 "Quality Requirements, Contractor Laboratory."

### **3.10 PROTECTION OF INSTALLED CONSTRUCTION**

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.

### **3.11 CORRECTION OF THE WORK**

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

**END OF SECTION**



## **SECTION 01 74 19**

### **CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

#### **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.

##### **1.2 SUMMARY**

- A. Section includes administrative and procedural requirements for the following:
  - 1. Recycling nonhazardous construction waste.
  - 2. Disposing of nonhazardous construction waste.
- B. Related Requirements:
  - 1. Section 04 22 00 "Concrete Unit Masonry" for disposal requirements for masonry waste.
  - 2. Section 31 10 00 "Site Clearing" for disposition of waste resulting from site clearing and removal of above - and below-grade improvements.

##### **1.3 DEFINITIONS**

- A. Source Separated Recycling Facility (SSRF): A facility that exclusively accepts separated individual commodities for the purpose of recycling; such as metals, paper, wood, and/or inerts such as asphalt and concrete.
- B. Mixed Debris: Includes solid items such as building materials, packaging, and rubble resulting from construction, remodeling, repair, and demolition operations.
- C. Class III Landfill: A landfill that accepts non-hazardous waste such as household, commercial, and industrial waste.
- D. Administrative Recycling Program: Separation and recovery of paper and beverage containers from both permanent administrative offices and construction site office(s).
- E. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- F. Demolition Waste: Building and site improvement materials resulting from demolition

CONSTRUCTION WASTE  
MANAGEMENT AND  
DISPOSAL  
01 74 19 - 1

or selective demolition operations.

- G. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- H. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- I. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- J. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. General: Achieve end-of-Project rates for salvage/recycling of 65 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Clearly label all recycling containers and list acceptable and unacceptable materials. Deliver recyclable materials to source separated recycling facilities. Facilitate recycling and salvage of materials, including the following as applicable:
  - 1. Demolition Waste:
    - a. Asphalt paving.
    - b. Concrete.
    - c. Concrete reinforcing steel.
    - d. Piping.
    - e. Sprinklers.
    - f. Electrical conduit.
    - g. Copper wiring.
    - h. Lighting fixtures.
    - i. Lamps.
    - j. Ballasts.
    - k. Electrical devices.
  - 2. Construction Waste:
    - a. Masonry and CMU.
    - b. Lumber.
    - c. Wood sheet materials.
    - d. Wood trim.
    - e. Metals.
    - f. Roofing.
    - g. Insulation.
    - h. Carpet and pad.
    - i. Gypsum board.
    - j. Piping.

- k. Electrical conduit.
- l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
  - 1) Paper.
  - 2) Cardboard.
  - 3) Boxes.
  - 4) Plastic sheet and film.
  - 5) Polystyrene packaging.
  - 6) Wood crates.
  - 7) Plastic pails.
- B. Co-mingled Debris: Direct all co-mingled site tonnage to the American Refuse Inc. Processing Facility. If alternate is requested, notify District Construction Manager.

## **1.5 ACTION SUBMITTALS**

- A. Waste Management Plan: Submit plan within 10 days of date established for the Notice to Proceed.

## **1.6 INFORMATIONAL SUBMITTALS**

- A. Shafter Waste Handling Plan: Concurrent with each Application for Payment, submit report.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Qualification Data: For Waste Management Coordinator.
- H. Disposal Manifests:
  - 1. Original manifests and receipts acknowledging disposal of all hazardous and

non-hazardous waste material from the project showing delivery date, quantity, and appropriate signature of landfill's authorized representative.

- a. Submit within 30 days of date that material was transported off site.

## **1.7 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Waste Management Conference: Prior to commencement of work, conduct conference at Project site. Attendees shall include District Construction Manager, Waste Management Coordinator, and Contractor personnel involved in demolition and waste handling. Review methods and procedures related to waste management, including:
  1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
  2. Review requirements for documenting quantities of each type of waste and its disposition.
  3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
  4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
  5. Review waste management requirements for each trade.

## **1.8 SITE DEBRIS MANAGEMENT PLAN**

- A. General: Develop a site debris management plan.
- B. Post approved plan in a prominent location at the Project site and distribute copies to superintendent and all subcontractors.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.1 PLAN IMPLEMENTATION**

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
  1. Comply with operation, termination, and removal requirements in Section 01 50 00 "Temporary Facilities and Controls."

- B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
  - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
  - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
  - 2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

**END OF SECTION**

**SECTION 01 77 00**  
**CLOSEOUT PROCEDURES**

**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.

**1.2 SUMMARY**

- A. Section includes administrative and procedural requirements for contract closeout, including:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. List of Incomplete Items.
  - 4. Warranties.
  - 5. Final cleaning.
  - 6. Repair of the Work.
- B. Related Requirements:
  - 1. Section 01 73 00 "Execution" for progress cleaning of Project site.
  - 2. Section 01 78 23 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
  - 3. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 4. Section 01 79 00 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

**1.3 DEFINITIONS**

- A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items.

- C. Certified List of Incomplete Items: Final submittal at final completion.

## **1.5 CLOSEOUT SUBMITTALS**

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Certificate of Construction-Phase Commissioning Process Completion.
- D. Field Report: For pest control inspection.
- E. Include: Site Waste Management Summary: Final summary of construction waste management data as specified in Section 01 74 19 "Construction Waste Management and Disposal."

## **1.6 MAINTENANCE MATERIAL SUBMITTALS**

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

## **1.7 SUBSTANTIAL COMPLETION PROCEDURES**

- A. Submittals Prior to Substantial Completion: Complete the following prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.
  - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
  - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 4. Certificate of Construction-Phase Commissioning Completion: Per Section 01 91 13 General Commissioning.
  - 5. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by District Construction Manager. Label with manufacturer's name and model number where applicable.
    - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain District Construction Manager's signature for receipt of submittals.
  - 6. Submit testing, adjusting, and balancing records.
  - 7. Submit changeover information related to District's occupancy, use, operation, and maintenance.

- B. Procedures Prior to Substantial Completion: Complete the following prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise District that site is ready for final changeover of permanent locks. District will make final changeover.
  2. Complete startup and testing of systems and equipment.
  3. Complete commissioning requirements.
  4. Perform preventive maintenance on equipment used prior to Substantial Completion.
  5. Advise District of changeover in utility services.
  6. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  7. Complete final cleaning requirements.
  8. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- C. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of seven days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect and Project Inspector will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for final completion.

## **1.8 FINAL COMPLETION PROCEDURES**

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list). Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
    - a. Certified:
      - 1) Signed and dated by person with authority to represent Contractor.
      - 2) Subsequent to 1) above, signed and dated by person with authority to represent Architect.
  2. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  3. Submit pest-control final inspection report.
  4. Instruct District's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."



- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of seven days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Project Inspector will either proceed with inspection or notify Contractor of unfulfilled requirements.
  - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

## **1.9 LIST OF INCOMPLETE ITEMS (PUNCH LIST)**

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
  - 1. Organize list of spaces in sequential order, .
  - 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  - 3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Contractor.
    - e. Page number.
  - 4. Submit List of Incomplete items in the following format:
    - a. MS Excel electronic file.
    - b. PDF electronic file.

## **1.10 SUBMITTAL OF PROJECT WARRANTIES**

- A. Time of Submittal: Submit written warranties for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
  - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
  - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
  - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
  - 1. Use cleaning products that comply with San Diego Air Pollution Control District allowable VOC levels.

## **PART 3 EXECUTION**

### **3.1 FINAL CLEANING**

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are not planted, mulched, or paved, to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    - f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - g. Sweep concrete floors broom clean in unoccupied spaces.
    - h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.

- i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - j. Remove labels that are not permanent.
  - k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
  - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
  - p. Leave Project clean and ready for occupancy.
- C. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 50 00 "Temporary Facilities and Controls." and Section 01 74 19 "Construction Waste Management and Disposal."

### **3.2 REPAIR OF THE WORK**

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
- 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
  - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
    - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

**END OF SECTION**

## **SECTION 01 78 23**

### **OPERATION AND MAINTENANCE DATA**

#### **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.

##### **1.2 SUMMARY**

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory manual.
  - 2. Systems and equipment operation manuals.
  - 3. Systems and equipment maintenance manuals.
  - 4. Product maintenance manuals.
- B. Related Requirements:
  - 1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
  - 2. Section 01 91 00 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

##### **1.3 DEFINITIONS**

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

##### **1.4 CLOSEOUT SUBMITTALS**

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before

commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.

- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
  - 1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.
- D. Delivery Media: Submit operation and maintenance manuals to District Construction Manager in the following media:
  - 1. Submit on digital media acceptable to District Construction Manager, by uploading to web-based project software site, and by email. Enable reviewer comments on draft submittals.
  - 2. Submit one paper copy.

## **1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS**

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
  - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
  - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
  - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## **1.6 COMMON REQUIREMENTS FOR OPERATION, AND MAINTENANCE MANUALS**

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  1. Title page.
  2. Table of contents.
  3. Manual contents.
- B. Title Page: Include the following information:
  1. Subject matter included in manual.
  2. Name and address of Project.
  3. Name and address of District.
  4. Date of submittal.
  5. Name and contact information for Contractor.
  6. Name and contact information for District Construction Manager.
  7. Name and contact information for Architect.
  8. Name and contact information for Commissioning Authority.
  9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
  10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
  1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single

binder.

- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."
- F. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
  - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- G. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original project record documents as part of operation and maintenance manuals.

## **1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL**

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to operation and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
  - 1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
  - 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
  - 3. Tables of Contents: Include a table of contents for each operation and maintenance manual.



## 1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by District's operating personnel.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
  - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  - 2. Performance and design criteria if Contractor has delegated design responsibility.
  - 3. Operating standards.
  - 4. Operating procedures.
  - 5. Operating logs.
  - 6. Wiring diagrams.
  - 7. Control diagrams.
  - 8. Piped system diagrams.
  - 9. Precautions against improper use.
  - 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
  - 1. Product name and model number. Use designations for products indicated on Contract Documents.
  - 2. Manufacturer's name.
  - 3. Equipment identification with serial number of each component.
  - 4. Equipment function.
  - 5. Operating characteristics.
  - 6. Limiting conditions.
  - 7. Performance curves.
  - 8. Engineering data and tests.
  - 9. Complete nomenclature and number of replacement parts.
- D. Operating Procedures: Include the following, as applicable:
  - 1. Startup procedures.
  - 2. Equipment or system break-in procedures.
  - 3. Routine and normal operating instructions.
  - 4. Regulation and control procedures.
  - 5. Instructions on stopping.
  - 6. Normal shutdown instructions.
  - 7. Seasonal and weekend operating instructions.
  - 8. Required sequences for electric or electronic systems.
  - 9. Special operating instructions and procedures.

- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## **1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS**

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by District's operating personnel.
- B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.
- C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
  - 1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
    - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
  - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  - 3. Identification and nomenclature of parts and components.
  - 4. List of items recommended to be stocked as spare parts.

- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
  - 1. Test and inspection instructions.
  - 2. Troubleshooting guide.
  - 3. Precautions against improper maintenance.
  - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - 5. Aligning, adjusting, and checking instructions.
  - 6. Demonstration and training video recording, if available.
- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
  - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

#### **1.10 PRODUCT MAINTENANCE MANUALS**

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
  - 1. Product name and model number.
  - 2. Manufacturer's name.
  - 3. Color, pattern, and texture.

4. Material and chemical composition.
  5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
  2. Types of cleaning agents to be used and methods of cleaning.
  3. List of cleaning agents and methods of cleaning detrimental to product.
  4. Schedule for routine cleaning and maintenance.
  5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION - NOT USED**

**END OF SECTION**

## **SECTION 01 78 39**

### **PROJECT RECORD DOCUMENTS**

#### **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.

##### **1.2 SUMMARY**

- A. Section includes administrative and procedural requirements for project record documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
  - 4. Miscellaneous record submittals.
- B. Related Requirements:
  - 1. Section 01 73 00 "Execution" for final property survey.
  - 2. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
  - 3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

##### **1.3 CLOSEOUT SUBMITTALS**

- A. Record Drawings: Submit one electronic copy of marked-up record prints.
- B. Record Specifications: Submit one electronic copy of marked-up record specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one electronic copy of each submittal.
  - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Include: Construction Waste Management Plan: Submit one electronic copy of construction waste management plan and a final summary of construction waste management data as specified in Section 01 74 19 "Construction Waste Management and Disposal."
- E. Include: Commissioning Report: Submit one electronic copy of the commissioning report as specified in Section 01 91 13 "General Commissioning Requirements."

- F. Include: SWPPP, C-WPCP, Post-Constructions BMPs: Submit one electronic copy of all record documents specified in Section 01 57 23 "Temporary Storm Water Pollution Control."

#### **1.4 RECORD DRAWINGS**

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued, depicting the current status of the Work.
1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an acceptable drawing technique.
    - c. Record data as soon as possible after obtaining it.
    - d. Record and check the markup before enclosing concealed installations.
  2. Content: Types of items requiring marking include:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing of piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.
    - h. Duct size and routing.
    - i. Locations of concealed internal utilities.
    - j. Changes made by Change Order, Construction Change Directive, or Field Work Order.
    - k. Changes made following Architect's written orders.
    - l. Details not on the original Contract Drawings.
    - m. Field records for variable and concealed conditions.
    - n. Record information on the Work that is shown only schematically.
    - o. Changes made by responses to Requests for Information (RFI's).
  3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, allowances applied, and similar identification, where applicable.

## **1.5 RECORD SPECIFICATIONS**

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  - 3. Note related Change Orders where applicable.

## **1.6 RECORD PRODUCT DATA**

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Note related Change Orders where applicable.

## **1.7 RECORDING AND MAINTENANCE**

- A. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's, Project Inspector's, and District Construction Manager's reference during normal working hours.
- B. Review Record Documents weekly with Project Inspector. Indicate to Project Inspector the items incorporated in Project Record Documents concurrent with progress of the Work, including modifications, concealed conditions, field changes, product selections, and other notations incorporated.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION - NOT USED**

**END OF SECTION**

## **SECTION 01 79 00**

### **DEMONSTRATION AND TRAINING**

#### **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.

##### **1.2 SUMMARY**

- A. Section includes administrative and procedural requirements for instructing District's personnel, including the following:
  - 1. Demonstration of operation of systems, subsystems, and equipment.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment.
  - 3. Demonstration and training video recordings.
- B. Related Requirements:
  - 1. Divisions 2 through 33 Sections for specific requirements for demonstration and training of products and systems in those Sections.

##### **1.3 INFORMATIONAL SUBMITTALS**

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
  - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Attendance Record: For each training module, submit list of participants and length of instruction time.

##### **1.4 CLOSEOUT SUBMITTALS**

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
  - 1. Identification: On each copy, provide an applied label with the following information:
    - a. Name of Project.



- b. Name and address of videographer.
  - c. Name of Architect.
  - d. Name of District Construction Manager.
  - e. Name of Contractor.
  - f. Names of Contractor Construction Manager, Project Manager, and Superintendent.
  - g. Date of video recording.
2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
  3. At completion of training, submit complete training manual(s) for District's use in PDF electronic file format.

## **1.5 QUALITY ASSURANCE**

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training including:
  1. Inspect and discuss locations and other facilities required for instruction.
  2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
  3. Review required content of instruction.
  4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

## **1.6 COORDINATION**

- A. Coordinate instruction schedule with District's operations. Adjust schedule as required to minimize disrupting District's operations and to ensure availability of District's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency,

operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed by Architect.

## **1.7 INSTRUCTION PROGRAM**

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
  - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  - 2. Documentation: Review the following items in detail:
    - a. Emergency manuals.
    - b. Systems and equipment operation manuals.
    - c. Systems and equipment maintenance manuals.
    - d. Product maintenance manuals.
    - e. Project record documents.
    - f. Identification systems.
    - g. Warranties and bonds.
    - h. Maintenance service agreements and similar continuing commitments.
  - 3. Emergencies: Include the following, as applicable:
    - a. Instructions on meaning of warnings, trouble indications, and error messages.
    - b. Instructions on stopping.
    - c. Shutdown instructions for each type of emergency.
    - d. Operating instructions for conditions outside of normal operating limits.
    - e. Sequences for electric or electronic systems.
    - f. Special operating instructions and procedures.
  - 4. Operations: Include the following, as applicable:
    - a. Startup procedures.
    - b. Equipment or system break-in procedures.
    - c. Routine and normal operating instructions.
    - d. Regulation and control procedures.
    - e. Control sequences.
    - f. Safety procedures.

- g. Instructions on stopping.
- h. Normal shutdown instructions.
- i. Operating procedures for emergencies.
- j. Operating procedures for system, subsystem, or equipment failure.
- k. Seasonal and weekend operating instructions.
- l. Required sequences for electric or electronic systems.
- m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
  - a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
  - a. Diagnostic instructions.
  - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
  - a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning.
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

## **1.8 PREPARATION**

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

## **1.9 INSTRUCTION**

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and District for number of participants, instruction times, and location.

- B. Engage qualified instructors to instruct District's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  - 1. District will furnish a representative to describe District's operational philosophy.
  - 2. District will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide instruction addressing seasonal operations variations.
  - 1. Schedule training with District, through District Construction Manager, with at least seven days' advance notice.
- D. Training Location: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. When necessary, provide classroom training.
  - 1. Webinar training is not acceptable.
- E. Reference Material: Conduct training using final operation and maintenance data submittals.
- F. Cleanup: Collect used and leftover educational materials and give to District. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

#### **1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS**

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
  - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Digital Video Recordings: Provide high-resolution, color digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode.
  - 1. Submit video recordings on thumb drive.
  - 2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
  - 3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
  - 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training thumb drive that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
    - a. Name of Contractor/Installer.
    - b. Business address.
    - c. Business phone number.
    - d. Point of contact.

- e. E-mail address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
  - 1. Film training session(s) in segments not to exceed 15 minutes.
    - a. Produce segments to present a single significant piece of equipment per segment.
    - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
  - 1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION - NOT USED**

### **END OF SECTION**

## **SECTION 01 91 00**

### **GENERAL COMMISSIONING REQUIREMENTS**

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

##### **1.01 REQUIREMENTS INCLUDED**

- A. Duties of Contractor
- B. Duties of Commissioning Authority
- C. Commissioning Plan
- D. Commissioning Electronic Folder
- E. Systems to be Commissioned
- F. Acceptance Procedures
- G. Performance Period
- H. Training and Instruction

##### **1.02 TERMS**

- A. Commissioning Plan: The preliminary Commissioning Plan has been prepared by the Owner's Commissioning Authority (CA), and shall be implemented by the Contractor and CA together. The commissioning plan (included) outlines the organization, scheduling, documentation, etc., pertaining to the overall commissioning process. A final plan shall be prepared after Contract Award as described below.
- B. Functional Performance Testing: That full range of checks and tests carried out to determine if all components, sub-systems, systems, and interfaces between systems function in accordance with the contract documents. In this context, "function" includes all modes and sequences of control operation, all interlocks and conditional control responses, and all specified responses to abnormal emergency conditions.
- C. Acceptable Performance: A component or system being able to meet specified design parameters under actual load including satisfactory documented completion of all functional performance tests, control system trending and resolution of outstanding issues.
- D. Commissioning: The process to assure the Owner that mechanical and electrical equipment, controls, and systems function together properly to meet performance requirements and design intent as shown in a composite manner in the Contract Documents.

##### **1.03 DUTIES OF CONTRACTOR**

- A. Collect the subcontractor and/or supplier information requested by Commissioning Authority for development of a complete Commissioning Plan, Commissioning Online Folder, and Functional Tests and provide to the Commissioning Authority. The Contractor and

appropriate subcontractors shall review these documents and confirm in writing to the Owner, Architect, and Commissioning Authority any known areas of conflict or areas requiring clarification.

- B. Collect all proposed start-up and Prefunctional documentation from appropriate subcontractors and provide that information to the Commissioning Authority. The Commissioning Authority will incorporate that information into the Commissioning Online Folder. The Commissioning Authority will provide the Contractor with the Commissioning Online Folder/Binder
- C. The Commissioning Online Folder will be stored in the Contractors field trailer and will be managed by the Contractor. The contractor shall confirm in writing to the Commissioning Authority that systems are complete, functional and the appropriate subcontractors have completed the specified tasks and signed off all pre-function startup checklist documentation.
- D. Coordinate directly with subcontractors on their specific responsibilities and contractual obligation.
- E. Coordinate the required Architect, Commissioning Authority, and Owner testing participation and approval procedures, after verifying that start-up and pretests have been satisfactorily conducted and final tests are ready to be performed.
- F. Review Operating and Maintenance Data provided by the various subcontractors and suppliers for verification, organization, distribution, and conformance to requirement of Contract Documents.

#### 1.04 DUTIES OF COMMISSIONING AUTHORITY

- A. The Owner will contract directly with a Commissioning Authority to direct the commissioning process through appropriate contract channels, perform functional test and recommend project completion from the commissioning perspective.
- B. The duties of the Commissioning Authority are:
  - 1. Develop the Commissioning Plan.
  - 2. Develop Functional Test Procedures from final Control documentation including narrative sequences of operation, control diagrams and software code, for execution with the assistance of Contractor staff as required.
  - 3. Develop the Commissioning Online Folder with appropriate documentation provided from Contractor. Provide supplemental documentation as necessary to ensure that all aspects of start-up and testing have been complete and documented prior to functional testing.
  - 4. Witness and verify satisfactory completion of equipment and component tests and systems and inter-systems functional performance tests.
  - 5. Provide site observation, Functional test or other project reports in a timely manner. Document inconsistencies or deficiencies in system operations and system compliance. System deficiencies shall be forwarded to the Owners Rep and tracked with normal punchlisting activities.
  - 6. Review contractor schedules for start-up and functional testing. This is to be coordinated with any required building purge or owner occupancy schedules required by the Owner.
  - 7. Review Testing Adjusting and Balancing (TAB) reports and witness and direct TAB in

verification effort.

8. Coordinate via the Construction Manager participation of Owner's personnel involved with equipment, component and systems performance verification and participation in required training.
  9. When commissioning has been successfully completed, recommend acceptance to the Owner.
  10. Verify that appropriate Operation and Maintenance Manuals and Project redline drawings have been provided by various subcontractors.
  11. Once all functional tests have been successfully completed and all outstanding issues resolved the Commissioning Authority will provide the owner with a final report of all commissioning activities that occurred during the project.
- C. The Commissioning Authority will formally communicate with the Contractor via approved project channels. It is expected, however, that informal communication and coordination will be conducted directly with the subcontractors, records of all contacts will be sent to the Architect through the normal channels.
- D. The Commissioning Authority is not authorized to modify, add to or revoke the requirements of the Contract Document. A change in the Work can only be made as provided in the General Conditions.

#### 1.05 PRELIMINARY COMMISSIONING PLAN

- A. This Preliminary Plan, details the implementation of the commissioning process. It includes the requirements that each party involved in the commissioning process will have to accomplish, including sequence, scheduling, documentation requirements, verification procedures, etc.
- B. Commissioning Activities:
1. The Commissioning Schedule. This schedule defines the milestones and conditions that must be achieved before system testing and other commissioning activities can commence. The schedule also includes the expected duration of the various tasks, so that the commissioning process can be incorporated into the overall construction schedule.
  2. Preparation for Testing. To prepare for the system performance testing, the Commissioning Authority will examine the design and construction documents, develop with appropriate contractors Pre-functional Test Checklists of construction responsibilities that must be completed prior to testing, and develop detailed Functional Test Procedures and data forms. Using the Pre-functional Test Checklists, each subcontractor must verify that the systems they install are in compliance with the construction documents and are fully functional. Commissioning is not intended to be a testing or inspection function that replaces any of the Contractors' obligations for testing and proof of performance. Functional testing will only begin when checklists are completed by the appropriate subcontractors, initialed, signed, and returned to the Commissioning Authority accompanied with a written letter from the Contractor indicating specific system completion.



3. Functional Testing. Functional testing is performed by the Commissioning Authority with the assistance of the Contractor to verify proper sequencing, operation and performance of installed equipment and systems under realistic operating conditions. As tests are successfully completed, a functional test checklist will be used to document the testing progress.
4. Documentation. In addition to the Pre-functional Test Checklists and Functional Test Procedures, written documentation will be maintained for all other commissioning activities. Project communication reports shall be issued by the Commissioning Authority to the Contractor and key members of the commissioning team to document apparent deficiencies identified during examination of design and construction documents, daily activities on-site, construction deficiencies, and successful or unsuccessful functional testing results. At the end of the commissioning process, all documentation will be assembled and summarized in the final commissioning report.
5. Commissioning Electronic Folder: The Commissioning Electronic Folder will be created by the Commissioning Authority and used by the contractors to identify and track all pertinent commissioning documentation required during the installation start-up and check-out phases. This Electronic Folder will be maintained by the Contractor on site and will be made available to all subcontractors for their use. The Electronic Folder provides a central location for the subcontractors and Commissioning Authority to identify, copy and organize all pertinent information.
6. Problem Resolution. When a project communication report is issued to address an identified deficiency, the Contractor shall forward the reports to the appropriate parties to initiate corrective action in an expeditious manner. Deficiencies will be tracked as part of the punch listing activity.

#### C. Commissioning Roles and Responsibilities

1. The responsibilities for commissioning are divided between the Architect; the General Contractor and its Subcontractors; and the Commissioning Authority as follows:
  - a. General Contractor
    - 1) Identify, coordinate, and incorporate commissioning activities with the Commissioning Authority and integrate into the general construction schedule.
    - 2) Coordinate participation of the Mechanical, Electrical, Controls and TAB Contractors in the commissioning process.
    - 3) Identify and coordinate delivery, start-up and related commissioning activities with vendors and manufacturer's representatives as required. Confirm accurate delivery of equipment upon receipt and forward all related manufacturer's documentation to Commissioning Authority.
    - 4) Forward appropriate copies of submittals, operation and maintenance manuals, and as-built drawings to the Commissioning Authority.
    - 5) Review the Commissioning Plan, project communication reports, and test results, and submit comments to the Commissioning Authority.
    - 6) In a timely manner, address issues identified during construction that may affect the commissioning process or final system performance.
    - 7) Conduct and provide minutes for regular commissioning meetings as determined appropriate with Owner's Representative and Commissioning Authority.

- 8) Issue written Notice of Readiness for each system identified in part 1.07 below to Commissioning Authority upon completion of all systems work, start-up and pre-functional test documentation requirements by trade contractors.
- b. Mechanical Contractor
- 1) Coordinate participation of the mechanical subcontractors in the commissioning process.
  - 2) Coordinate installation of mechanical systems and equipment with equipment suppliers, mechanical subcontractors, and electrical contractor. Verify that coordination, installation, quality control, and final subcontractor testing have been completed such that installed systems and equipment comply with construction documents.
  - 3) Notify the Construction Manager, General Contractor and Commissioning Authority as soon as possible of any issues identified during construction that may affect the commissioning process or final system performance.
  - 4) Provide proposed installation, start-up and pre-functional testing documentation for equipment noted in 1.07 below to Commissioning Authority for review within 90 days of Notice to Proceed.
  - 5) Perform start-up and testing of mechanical equipment and systems and document as required with start-up reports and completion of Pre-functional Test Checklists. Reports will be stored in the General Contractors field trailer.
  - 6) Lead verification testing of Fire/Smoke dampers and direct appropriate subcontractors in the resolution of deficiencies. Each damper and all functions of shall be tracked in a matrix-spread sheet.
  - 7) Operate equipment and systems as required for functional performance testing.
  - 8) Participate in the fine-tuning or troubleshooting of system performance if either of these measures becomes necessary.
  - 9) Submit complete operation and maintenance information and as-built drawings to the general contractor for verification, organization, and distribution.
  - 10) Provide training for the systems specified.
  - 11) The installing contractor shall provide (complete and signed) all required "Acceptance Testing" form per 2022 California Title-24 Energy Code.
- c. Electrical Contractor
- 1) Coordinate installation of electrical systems and equipment with equipment suppliers, electrical subcontractors, and mechanical contractor. Verify that coordination, installation, quality control, and final subcontractor testing have been completed such that installed systems and equipment comply with construction documents.
  - 2) Notify the Construction Manager, General Contractor and Commissioning Authority immediately of any issues identified during construction that may affect the commissioning process or final system performance.

- 3) Provide proposed installation, start-up and testing documentation to be used for the required systems noted in the specifications and summarized in part 1.07 below to Commissioning Authority for review within 90 days of Notice to Proceed.
  - 4) Perform start-up and testing of electrical equipment and systems and document with start-up reports and completion of Pre-functional Test. Reports will be stored in the General Contractors field trailer.
  - 5) Operate equipment and systems as required for functional performance testing.
  - 6) Participate in fine-tuning or troubleshooting of system performance if either of these measures becomes necessary.
  - 7) Provide complete operation and maintenance information and as-built drawings to the general contractor for verification, organization, and distribution.
  - 8) Provide training for the systems specified.
  - 9) The installing contractor shall provide (complete and signed) all required "Acceptance Testing" form per 2022 California Title-24 Energy Code.
- d. Controls Contractor (or Mechanical Contractor representative for distributed control components)
- 1) Provide Commissioning Authority and Mechanical Contractor with controls system and wiring diagrams and narrative sequences of operation, approved by the Mechanical design consultant, in time for use in preparing the Functional Test Procedures.
  - 2) Review the Commissioning Plan, schedule, and Functional Test Procedures. Provide input required to develop final plans and procedures as a fair means of compliance with commissioning goals and the project contract.
  - 3) Participate in efforts to finalize sequences of operations with Owner, Designers, and Commissioning Authority.
  - 4) Coordinate installation of controls system with equipment suppliers, mechanical subcontractors, and electrical contractor. Verify that coordination, installation, quality control, and final subcontractor testing have been completed such that installed systems and equipment comply with construction documents.
  - 5) Notify the Commissioning Authority, Designers and Construction Manager as soon as possible of any system installation issues identified during construction that may compromise system control capability.
  - 6) Participate in start-up and functional testing as required. This will require dedicated, full-time support of the Commissioning Authority's functional testing efforts during commissioning.
  - 7) Provide proposed installation, start-up and testing documentation to be used for the required systems noted in the specifications and summarized in part 1.07 below to Commissioning Authority for review within 90 days of Notice to Proceed.
  - 8) Complete Pre-functional Test Checklists and other supporting documentation as required demonstrating completion of control system installation, point-to-point verification (including sensor calibration), start-up and testing prior to the initiation of functional testing. Reports will be stored in the General Contractors field trailer.

- 9) Support the Commissioning Authority in functional testing of each of the systems. The Controls Contractor shall manipulate the controls systems to achieve the expected response for the functional test procedure.
  - 10) Participate in fine-tuning or troubleshooting of system performance if either of these measures becomes necessary.
  - 11) Provide the Commissioning Authority and Construction Manager with final documentation for all installed conditions, including as-built drawings and detailed narrative sequences of operation as determined during commissioning process.
  - 12) Coordinate activities as necessary with Test, Adjust and Balance Contractor as required for determining appropriate equipment and device locations, identifying and recording various set points and calibration values, and documenting same to Commissioning Authority.
- e. Test, Adjust, and Balance Contractor
- 1) Review the Commissioning Plan, schedule, and Functional Test Procedures. Provide the input required to develop final plans and procedures.
  - 2) Provide a Contract Documents Examination report indicating a review of Drawings, Specifications, Issues, Field Notices and A/E reviewed submittals. Verify that piping, instruments, wells, taps, valves, ductwork, duct specialties, dampers, flow measuring elements, access openings and other accessories; have been provided in correct quantity and at correct locations to permit balancing of piping and air systems under testing and operating conditions.
  - 3) Coordinate balancing activities with those of the Mechanical and Controls contractors. Verify that coordination, installation, quality control, and final subcontractor testing have been completed to allow proper balancing work to be performed.
  - 4) Notify the Commissioning Authority, Designers and Construction Manager as soon as possible of any system installation or performance issues that may compromise the ability of the system to be balanced.
  - 5) Participate in start-up and testing as required.
  - 6) Complete appropriate portions of mechanical, electrical and TAB Pre-functional Test Checklists to verify completion of system balancing tasks. Reports will be stored in the General Contractors field trailer.
  - 7) Organize and run a Pre-Balance Conference one week prior to commencement of balance work. At this juncture, all Contractors are to provide a comprehensive list of any outstanding design, installation or performance deficiencies which may impede TAB or functional testing activities. This will address those items not already resolved during installation verification and pre-functional testing deficiency tracking process.
  - 8) Provide preliminary TAB report, indicating all actual field values recorded, to the Commissioning Authority, prior to initiation of functional testing. These reports shall be incorporated in the Commissioning Online Folder
  - 9) Participate in fine-tuning or troubleshooting of system performance if either of these measures becomes necessary.

f. Commissioning Authority

- 1) Perform commissioning submittal review to verify suitability and compliance with specifications.
- 2) Revise the Commissioning Plan as necessary to incorporate post-award conditions.
- 3) Provide supplemental Pre-Functional Test documentation forms for all equipment to be commissioned with coordination of subcontractor's specified documentation. Documentation will be coordinated by the Commissioning Authority and installed in a Commissioning Electronic Folder. The Electronic Folder will be created by the Commissioning Authority and maintained and managed the by General Contractor.
- 4) Organize meetings to finalize the controls system I/O Points List and Sequences of Operation as needed. The meeting will be supported by the Owner's Representative, Designer and Controls Contractor.
- 5) Write Functional Test Procedures and transmit to subcontractors for review. After review period changes will be incorporated and test will be performed.
- 6) Perform site observations to follow installation progress, and to verify system installation quality and readiness for testing.
- 7) Observe the start-up activities and initial testing of equipment and systems as required, and review contractor start-up documentation. Verify that the specified training schedule of Owner's personnel is provided.
- 8) Review submittal of all required Pre-functional and start-up documentation provided by contractors for completeness and reasonableness. This includes Controls Subcontractor's point to point checklists and TAB Subcontractor's completed preliminary TAB report prior to initiation of functional testing.
- 9) Direct and perform functional test with assistance from subcontractors as required.
- 10) Issue project communication reports as necessary to document activities, progress, and deficiencies.
- 11) Assemble all test results and other required documentation into the final commissioning report.

D. The functional test procedures include, but are not limited to, the following:

1. Verification of Testing, adjusting and balancing performance;
2. Verification of all equipment performance;
3. Verification of the performance of subsystems consisting of combinations of equipment (i.e. refrigeration cycle, pumps, chillers, cooling towers, and interconnecting piping);
4. Verification of the performance of the automatic controls in all seasonal modes;
5. Verification of the performance of the HVAC system as a whole;
6. Verification of the performance of all life safety devices and systems as the interface with the HVAC systems.
7. Verification of third-party testing and documentation review.

1.06 COMMISSIONING ELECTRONIC FOLDER

- A. The Commissioning Electronic Folder will be assembled by the Commissioning Authority and use by the contractors to identify and track all pertinent commissioning documentation. This Electronic Folder will be maintained by the Construction Manager on site and will be made available to all subcontractors for their use. The Electronic Folder provides a central location for the Commissioning Authority to identify, copy and organize all pertinent information and will include the following format:
  - 1. Summary describing Electronic Folder contents and use.
  - 2. Copy of Commissioning Plan for contractor field reference.
  - 3. Listing of all specification documentation requirements listed by specification section, with construction completion sign offs for appropriate parties.
- B. Tabs for each specification section with copies of pre-functional test check sheets provided by coordination of subcontractors and Commissioning Authority for contractor completion and space for related contractor-supplied documents.

#### 1.07 CALIFORNIA TITLE-24 COMMISSIONING SCOPE:

- A. Per 2022 California Energy Code Part 6, Title 24/CalGreen requirements, LP Engineers will coordinate and lead, review and oversee the completion of the following commissioning process activities:
  - 1. Design Review:
    - a. Schematic Design Phase: meet with design team to discuss project scope, schedule and how the team will coordinate. The design team shall review the "Design Review Checklist" form NRCC-CXR-02-E. Form NRCC-CXR-01-E shall be provided to document the Design Review Kickoff.
    - b. Construction Documents Design Review: The construction documents shall be reviewed in accordance with CEC Section 120.8 (d). The design review forms NRCC-CX-02-E, NRCC-CX-03-E, NRCC-CX-04-E and NRCC-CX-05-E shall be completed as applicable.
  - 2. The Owner will document the Owner's project requirements. The design team will document the basis of design for the Project. The Owner and the design team shall make updates to these documents during design and construction. LP Engineers will facilitate this process and review the documents for clarity and completeness.
  - 3. LP Engineers will develop and incorporate commissioning requirements into the construction documents specifications.
  - 4. LP Engineers will develop and utilize a commissioning plan that will be used throughout the commissioning process.
  - 5. LP Engineers will verify that the installation and performance of energy consuming systems meet the Owner's project requirements and basis of design.
    - a. Conduct Commissioning Meetings as deemed necessary by the CxA with the construction team throughout the duration of the project to review progress to date, any commissioning issues, documentation and reporting.

- b. Conduct Commissioning Site Observations throughout the duration of the project as deemed necessary by the CxA. Construction progress and installation will be reviewed and a Site Observation Report submitted after each visit.
- 6. Review installing contractor provided "Acceptance Test" checklists to confirm that individual components of a system are installed properly per California Title-24.
- 7. Contractor Submittal Review:
  - a. Review contractor submittals applicable to systems being commissioned.
- 8. Develop Functional Testing Procedures to be carried out by the contractors, witness and record the results. The Functional Test Results will be evaluated to confirm that the commissioned systems are functioning in accordance with the Owner's Project Requirements and the Basis of Design.
- 9. System Manual:
  - a. Develop a system manual that provides future operating staff the information needed to understand and optimally operate the commissioned systems.
- 10. Operating Personnel Training:
  - a. Verify that the requirements for training operating personnel and building occupants are completed.
- 11. Exclusions: LP Engineers will not provide the "Acceptance Testing Forms" (Envelope, Mechanical, Plumbing, Process and Electrical). The installing contractor shall provide (complete and sign) all required "Acceptance Testing" forms per 2022 California Title-24 Energy Code.
- 12. LP Engineers will complete a Commissioning Report which will include at a minimum:
  - a. An Executive Summary with results of the Commissioning Process including observations, conclusions and any outstanding items.
  - b. A Commissioning Issue Log identifying deficiencies discovered during the commissioning process, how they were resolved and any seasonal testing scheduled for a later date.
  - c. System performance test results including the Start-up Pre-functional Checklists and Functional Test Results.

## **PART 2 - PRODUCTS**

### **2.01 NOT USED**

## **PART 3 - EXECUTION**

### **3.01 GENERAL**

- A. Operating equipment and systems shall be tested in presence of Owner's Commissioning Authority and Architect to demonstrate compliance with specified requirements.
  - 1. Notify Owner, in writing, seven (7) days prior to tests scheduled under requirements of this Section.
  - 2. Testing shall be conducted under specified design operating conditions as recommended

or approved by Owner and Architect.

- B. Functional Performance Testing shall be completed and accepted by Owner as a condition of Final Completion.
- C. All elements of systems shall be tested to demonstrate that total systems satisfy all requirements of these Specifications. Testing shall be accomplished on hierarchical basis. Test each piece of equipment for proper operation, followed by each subsystem, followed by entire system, followed by entireties to other major systems.
- D. All special testing materials and equipment shall be provided by Contractor.
- E. Acceptance Documentation. A copy of the Commissioning Plan and Functional Performance test results shall be included with each copy of the Operations and Maintenance Manuals.

### 3.02 ACCEPTANCE PROCEDURES

- A. Prior to functional performance testing of each system, the Commissioning Authority shall observe and verify that the physical installation of components and systems being tested is substantially installed in accordance with the contract documents.
- B. Contractor's Tests:
  - 1. System shall be checked for proper installation, shall be adjusted, and shall be calibrated to verify that it is ready to function as specified.
  - 2. All system elements shall be checked to verify that they have been installed properly and that all connections have been made correctly.
  - 3. All discrete elements and sub-systems shall be adjusted and shall be checked for proper operation.
  - 4. Start-up and Operational Tests shall be complete, with all required pre-functional testing documentation included in the Field Commissioning Electronic Folder submitted for review by Commissioning Authority within five (5) days of each activity, prior to starting Functional Acceptance Tests.
- C. Owner-Witnessed Functional Tests:
  - 1. Objective of these tests is to demonstrate that system is operating and complying with specified performance requirements.
  - 2. Owner-witnessed Functional Performance Tests shall be performed on complete system. Each function shall be demonstrated to satisfaction of Architect and Owner's Commissioning Authority on paragraph-by-paragraph basis of Commissioning Authority's written test procedure, developed to demonstrate conformance to requirements of Contract Specifications.
  - 3. Functional Performance Test shall be witnessed and signed off by Commissioning Authority upon satisfactory completion.
  - 4. Actual testing program shall be conducted in accordance with prior approved procedures and shall be documented as required herein.
  - 5. Contractor shall notify Architect and Owner at least two weeks prior to date of Functional



#### Performance Tests.

- D. The functional performance testing process shall be accomplished for all equipment, subsystems, systems, and system interfaces. All must be tested for acceptances, and there shall be a separate checklist for each to ensure documentation specific to each is complete.
- E. Each system shall be operated through all modes of system operation (for example, seasonal, occupied, unoccupied, warm-up, cool-down, etc, as applicable) including every individual interlock and conditional control logic, all control sequences, both full-load and part-load conditions, and simulation of all abnormal conditions for which there is a specified system or controls response.
- F. Temporary upsets of systems, such as distribution fault, control loss, setpoint change, equilibrium upset, and component failure, shall be imposed at different operation loads to determine system stability and recovery time.
- G. When the functional performance of all individual systems has been proven, the interface or coordinated responses between systems shall be checked. The systems involved may be within the overall HVAC work, or they may involve other systems, such as emergency systems for life safety.
- H. Corrective Measures: If acceptable performance cannot be achieved, then necessary corrective measures shall be carried out by the Contractor. Every check or test for which acceptable performance was not achieved shall be repeated after the necessary corrective measures have been completed. This re-testing process should be repeated until acceptable performance is achieved. The Contractor will be allowed one retest after initial testing of the equipment. If the retest fails the contractor shall be financially responsible, at standard rates, to reimburse the owner representatives for the additional time taken to achieve acceptable performance.

### 3.03 TRAINING AND INSTRUCTION

- A. Training and instruction of Owner personnel is a part of the commissioning process and essential for the proper operation of the facility. The Contractor shall coordinate commissioning activities with training of Owner personnel. Detailed requirements for training and instruction are contained in other sections of the Contract Documents including, but not limited to, Divisions 22, 23, and Division 26.

#### **END OF SECTION**

## **SECTION 03 30 00**

### **CAST-IN-PLACE CONCRETE**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
  - 1. Section 03 35 43 "Polished Concrete Finishing."

##### **1.2 DEFINITIONS**

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

##### **1.3 PRE-INSTALLATION MEETINGS**

- A. Pre-installation Conference: Conduct conference at Project site.
  - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Concrete Subcontractor.
    - d. Special concrete finish Subcontractor.
  - 2. Review concrete finishes and finishing,, hot-weather concreting procedures,, curing procedures,, construction contraction and isolation joints, and joint-filler strips,, vapor-retarder installation,, concrete mix design including admixtures,, quality control and testing including test cores,, steel reinforcement installation,, floor and slab flatness and levelness measurement,, and Polished Concrete finishing system requirements and concrete protection.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when

characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
  - 1. Location of construction joints is subject to approval of the Architect and Project Inspector.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.
- B. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Steel reinforcement and accessories.
  - 4. Floor and slab treatments.
- C. Material Test Reports: For the following, from a qualified testing agency:
  - 1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

## **1.6 QUALITY ASSURANCE**

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.
- C. Regulatory Requirements: Concrete construction shall conform with the CBC, and requirements specified herein.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

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

## **1.8 FIELD CONDITIONS**

- A. Hot-Weather Placement: Comply with ACI 301 and as follows:
  - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

## **PART 2 PRODUCTS**

### **2.1 CONCRETE, GENERAL**

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301. "Specifications for Structural Concrete".
  - 2. ACI 117. "Specifications for Tolerances for Concrete Construction and Materials".

### **2.2 FORM-FACING MATERIALS**

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  - 1. Plywood, metal, or other approved panel materials.
  - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. High-density overlay, Class 1 or better.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4-by-3/4-inch, minimum.
- G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

- H. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- I. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish units that leave no corrodible metal closer than 1-inch to the plane of exposed concrete surface.
  - 2. Furnish ties that, when removed, leave holes no larger than 1-inch in diameter in concrete surface.

## **2.3 STEEL REINFORCEMENT**

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

## **2.4 REINFORCEMENT ACCESSORIES**

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Zinc Repair Material: ASTM A 780/A 780M.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
  - 1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

## **2.5 CONCRETE MATERIALS**

- A. Source Limitations:
  - 1. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
  - 2. Obtain aggregate from single source.
  - 3. Obtain all other admixtures from single source from single manufacturer.
  - 4. Verify compatibility of admixtures with polished concrete floor treatments.
- B. Cementitious Materials:
  - 1. Portland Cement: ASTM C 150/C 150M, Type II or Type V, gray.
  - 2. Fly Ash: ASTM C 618, Class F.
  - 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
  - 4. Silica Fume: ASTM C 1240, amorphous silica.

- C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 1N coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
  - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal, nor one third of the slab depth, not three-fourths of the minimum clear spacing between individual reinforcing bars or bundles of bars.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
  - 3. Do not use aggregates containing spalling causing deleterious substances.
- D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures, flooring materials and adhesives, and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- E. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Corporation-Construction Systems.
    - b. Grace Construction Products; W.R. Grace & Co. -- Conn.
    - c. Sika Corporation.
    - d. Or Equal.
- F. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Corporation-Construction Systems.
    - b. Grace Construction Products; W.R. Grace & Co. -- Conn.
    - c. Sika Corporation.
    - d. Or Equal.
- G. Color Pigment: ASTM C 979/C 979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Brickform; a division of Solomon Colors.

- b. Davis Colors.
- c. Proline Concrete Tools, Inc.
- d. Or Equal.
- 2. Color: As selected by Architect from manufacturer's full range.

H. Water: ASTM C 94/C 94M and potable.

## **2.6 VAPOR RETARDERS**

- A. Vapor Retarder: Plastic sheet, ASTM E 1745, Class A.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Fortifiber Building Systems Group.
    - b. Raven Industries, Inc.
    - c. Reef Industries, Inc.
    - d. Stego Industries, LLC.
    - e. W.R. Meadows, Inc.
    - f. Or Equal.

## **2.7 FLOOR AND SLAB TREATMENTS**

- A. Reference 03 35 43 "Polished Concrete Finishing" floor slab treatments.

## **2.8 CURING MATERIALS**

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. Verify compatibility with polished concrete floor treatment manufacturers.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF Corporation-Construction Systems.
    - b. Euclid Chemical Company (The); an RPM company.
    - c. Sika Corporation.
    - d. Or Equal.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating, conforming to VOC requirements of the local Air Pollution Control District.

## 2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Semi-rigid Joint Filler: Two-component, semi-rigid, 100 percent solids, aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 according to ASTM D 2240.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
  - 1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Reglets: Fabricate reglets of not less than 0.022-inch-thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034-inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

## 2.10 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of Portland cement, which would otherwise be used, by not more than 20 percent. and Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
  - 1. Fly Ash: 15 percent.
  - 2. Combined Fly Ash and Pozzolan: 15 percent.
  - 3. Slag Cement: 20 percent.
  - 4. Combined Fly Ash or Pozzolan and Slag Cement: 80 percent Portland cement minimum, with fly ash or pozzolan not exceeding 15 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.1 percent by weight of cement.
- D. Admixtures: Use admixtures certified by manufacturer to be compatible with other admixtures, flooring materials and adhesives. Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing admixture in concrete, as required, for placement and



- workability.
  - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.45.
  - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
  - 5. Use of admixtures shall require approval of the Architect and DSA.
- E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved sample.

## **2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS**

- A. Footings: Normal-weight concrete.
- 1. Minimum Compressive Strength: 3000 psi at 28 days.
  - 2. Maximum W/C Ratio: 0.55.
  - 3. Slump Limit: 4 inches, plus or minus 1 inch.
  - 4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
- B. Foundation Walls: Normal-weight concrete.
- 1. Minimum Compressive Strength: 3000 psi at 28 days.
  - 2. Maximum W/C Ratio: 0.55.
  - 3. Slump Limit: 4 inches, plus or minus 1 inch.
  - 4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
- C. Slabs-on-Grade: Normal-weight concrete.
- 1. Minimum Compressive Strength: 4000 psi at 28 days.
  - 2. Maximum W/C Ratio: 0.45.
  - 3. Minimum Cementitious Materials Content: 5 1/2 sacks per cubic yard.
  - 4. Slump Limit: 4 inches, plus or minus 1/2-inch.
  - 5. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
  - 6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
  - 7. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of.
  - 8. Vapor Emissions Control System Admixture: Add per manufacturer's requirements to ready-mix truck at batch plant, or at jobsite before discharge. Mix following manufacturer's instructions. To be used in lieu of design mix water, not in addition to mix water. Do not alter water/cement ratio. Manufacturer representative must be present for mixing, dosing and dispensing. Required at all concrete subfloors to receive flooring finishes.

## **2.12 FABRICATING REINFORCEMENT**

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

## **2.13 CONCRETE MIXING**

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
  - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

## **PART 3 EXECUTION**

### **3.1 FORMWORK INSTALLATION**

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
  - 1. Class A, 1/8-inch for smooth-formed finished surfaces.
  - 2. Class C, 1/2-inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 1. Install keyways, reglets, recesses, and the like, for easy removal.
  - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood,

sawdust, dirt, and other debris just before placing concrete.

- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### **3.2 EMBEDDED ITEM INSTALLATION**

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
  - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
  - 3. Install dovetail anchor slots in concrete structures as indicated.

### **3.3 REMOVING AND REUSING FORMS**

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
  - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.
  - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
  - 3. Determine compressive strength of in-place concrete by testing representative field or laboratory-cured test specimens according to ACI 301.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

### **3.4 SHORING AND RESHORING INSTALLATION**

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
  - 1. Do not remove shoring or reshoring until measurement of slab tolerances is

complete.

- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

### **3.5 VAPOR-RETARDER INSTALLATION**

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
  - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

### **3.6 STEEL REINFORCEMENT INSTALLATION**

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
  - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780/A 780M. Use galvanized-steel wire ties to fasten zinc-coated steel reinforcement.

### **3.7 JOINTS**

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by the Project Inspector.
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8-inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  2. Sawed Joints at Polished Concrete Locations: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
  2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

### **3.8 CONCRETE PLACEMENT**

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by the Project Inspector.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
  1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
  - 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Maintain reinforcement in position on chairs during concrete placement.
  - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 4. Slope surfaces uniformly to drains where required.
  - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

### **3.9 FINISHING FORMED SURFACES**

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
  - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
  - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
  - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
  - 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part Portland cement to 1-

1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white Portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

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

### **3.10 FINISHING FLOORS AND SLABS**

- A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
  - 1. Coordinate requirements with 03 35 43 "Polished Concrete Finishing".
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.
  - 1. Apply float finish to surfaces to receive trowel finish.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  - 1. Apply a trowel finish to surfaces exposed to view.
  - 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    - a. Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.

### **3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION**

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
  - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
  - 2. Construct concrete bases 4 inches high unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of

- supported equipment unless otherwise indicated or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi at 28 days.
  4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
  5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
  6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

### **3.12 CONCRETE PROTECTING AND CURING**

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.



Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

- a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
  - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
  - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
- a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

### **3.13 JOINT FILLING**

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semi-rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

### **3.14 CONCRETE SURFACE REPAIRS**

- A. Defective Concrete: Repair and patch defective areas when approved by the District Construction Manager. Remove and replace concrete that cannot be repaired and patched to District Construction Manager's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2-inch in any dimension to solid concrete. Limit cut depth to 3/4-inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar matches

- surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by the District Construction Manager.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01-inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  2. After concrete has cured at least 14 days, correct high areas by grinding.
  3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
  5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4- inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  6. Repair defective areas and test cores, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
  7. Cracks.
    - a. Repair random cracks and single holes 1 inch or less in diameter.
    - b. General: Repair with patching mortar.
    - c. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place crack repair material before bonding agent has dried. Compact crack repair material and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to District Construction Manager's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to District Construction Manager's approval.

### **3.15 FIELD QUALITY CONTROL**

- A. Special Inspections: District will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
  - 1. Steel reinforcement placement.
  - 2. Steel reinforcement welding.
  - 3. Headed bolts and studs.
  - 4. Verification of use of required design mixture.
  - 5. Concrete placement, including conveying and depositing.
  - 6. Curing procedures and maintenance of curing temperature.
  - 7. Verification of concrete strength before removal of shores and forms from beams and slabs.

### **3.16 PROTECTION OF LIQUID FLOOR TREATMENTS**

- A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

**END OF SECTION**

**SECTION 03 35 43**  
**POLISHED CONCRETE FINISHING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Liquid floor treatments.
  - 2. Concrete polishing.
- B. Related Requirements:
  - 1. Section 033000 Cast-in-Place Concrete: Concrete materials, mix designs, placement procedures, flatness, levelness, initial finishing, and curing.

**1.2 ACTION SUBMITTALS**

- A. Product Data:
  - 1. Liquid floor treatments.
  - 2. Repair materials.
- B. Shop Drawings: Plan showing polished concrete surfaces and schedule of polishing operations. Include locations of construction joints and cold joints.

**1.3 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: Recommendations for cleaning and maintaining polished concrete finishes.
- B. Warranty Documentation: For polished concrete.

**1.4 QUALITY ASSURANCE**

- A. Mockups: Construct 3'x3' minimum size. Demonstrate product interfaces, intersections, and terminations.
  - 1. Mockup Locations: Coordinate with Architect.
  - 2. Approved mockups establish products and work results standard.

## **PART 2 PRODUCTS**

### **2.1 FLOOR TREATMENTS - GENERAL**

- A. Source Control: Provide floor treatments from one manufacturer.

### **2.2 LIQUID FLOOR TREATMENTS**

- A. Penetrating Liquid Floor Treatment: Waterborne silicate or silicate penetrating hardener.
1. Manufacturers and Products:
    - a. Curecrete Retro Plate 99.
    - b. Euclid Chemical Company Ultrasil Li.
    - c. Green Umbrella, Dryshield.
    - d. Laticrete L & M FGS Hardener Plus.
    - e. PROSOCO, Inc. Consolidock LS.
    - f. Solomon Colors Lythic Densifier.
    - g. Or approved equal.
  2. Finish: Clear.
  3. VOC compliant.
  4. Provide product that will accept an additional coat of grit-infused sealer for areas indicated as "Polished Concrete Slip Resistant" on drawings.
- B. Penetrating Concrete Sealer.
1. Manufacturers and Products: Provide sealer produced, or acceptable to, manufacturer of Penetrating Liquid Floor Treatment.
  2. Properties: Penetrating oil and water repellent, water-based fluoropolymer.
  3. Finish: Clear.
  4. Sheen: Low.
- C. Grit-infused Sealer (Restrooms and Kitchen).
1. Manufacturers and Products: Provide sealer produced, or acceptable to, manufacturer of Penetrating Liquid Floor Treatment:
    - a. Crown Polymers 8100 Crowncote HP.
    - b. Sikafloor 315N.
    - c. Sherwin Williams Resutile HTS 100.
    - d. Or approved equal.
  2. Properties: high solids, two-component, abrasion, chemical and stain-resistant aliphatic polyurethane finish coat.
  3. Finish: Clear.
  4. Sheen: Low.
  5. Provide Manufacturer-recommended primer. Confirm with manufacturer's representative for specific project requirements.
  6. Additive: Aluminum oxide or manufacturer's standard to produce the desired slip-resistance.
- D. Accessory Materials: Penetrating floor treatment manufacturer recommended joint fillers, sealers, and cleaning solutions.

## **2.3 PERFORMANCE**

- A. Dynamic Coefficient of Friction: Tested per.
  - 1. Level Floor Surfaces: 0.42 minimum.
- B. Physical Characteristics: Provide plant-mixed concrete per Section 033000 and the following:
  - 1. Coordinate mix of concrete with installer and manufacturer of polished concrete finishing systems to produce performance and aesthetic criteria indicated.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Concrete Slabs: Verify substrates are acceptable for polishing.
  - 1. Verify concrete is fully cured and meets flatness specified in Section 033000.

### **3.2 PREPARATION**

- A. Clean concrete surfaces of dirt and other foreign matter harmful to concrete finishing material performance.
- B. Fill surface imperfections using manufacturer recommended materials. Grind smooth and level.
- C. Protect adjacent areas from overspray.

### **3.3 POLISHING**

- A. Final Polishing Work Results:
  - 1. Gloss: CPC Appearance Chart Level 2 and , 200 grit.
- B. Floor Polishing:
  - 1. Machine grind floor level and smooth.
  - 2. Apply liquid floor hardener. Allow recommend drying time between coats.
  - 3. Polish floor with progressively finer grit diamond pads; achieve specified gloss level.
  - 4. At general use locations: Apply 2 coats penetrating concrete sealer. Allow recommend drying time between coats.
  - 5. At restrooms and kitchen locations: Apply grit-infused sealer system. Allow recommend drying time between coats.
  - 6. Neutralize and clean polished floor surfaces.
- C. Remove defects and repolish defective areas.
- D. Finish edges of floor finish adjoining other materials in clean and sharp manner.

### **3.4 CLEANING**

- A. Mechanically scrub treated floors with soft to medium pads and manufacturer approved cleaning solution.

### **3.5 PROTECTION**

- A. Protect polished concrete floor from damage during subsequent construction operations and placement of equipment and fixtures.

**END OF SECTION**

**SECTION 04 22 00**  
**CONCRETE UNIT MASONRY**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Concrete masonry units.
  - 2. Mortar and grout.
  - 3. Steel reinforcing bars.
  - 4. Masonry-joint reinforcement.
  - 5. Miscellaneous masonry accessories.
  - 6. Masonry-cell fill.
- B. Related Requirements:
  - 1. Section 09 91 13 "Exterior Painting" for block filler at interior of trash encloser.

**1.2 DEFINITIONS**

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
  - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
  - 2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Material Test Reports: Signed by manufacturers certifying that each of the following items complies with requirements indicated:
  - 1. Each type of masonry unit required.
  - 2. Grout mixes complying with compressive strength requirements of ASTM C 476. Include description of type and proportions of grout ingredients.
- B. Material Certificates: For each type and size of the following:
  - 1. Masonry units.
  - 2. Grout mixes. Include description of type and proportions of ingredients.



3. Reinforcing bars.
- C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
  1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.

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

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
  1. Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

## **1.6 FIELD CONDITIONS**

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6. Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.
  1. When ambient temperature exceeds 100 deg. F, or 90 deg. F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48-inches ahead of masonry. Set masonry units within one minute of spreading mortar.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

### **2.2 UNIT MASONRY, GENERAL**

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

### **2.3 CONCRETE MASONRY UNITS**

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
  - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
  - 2. Provide square-edged units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C 90.
  - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
  - 2. Density Classification: Light weight.
  - 3. Size (Width): Manufactured to dimensions 3/8-inch less-than-nominal dimensions.
  - 4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

### **2.4 MORTAR AND GROUT MATERIALS**

- A. Portland Cement: ASTM C 150/C 150M, Type I or II. Provide natural color or white cement as required to produce mortar color indicated.
  - 1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.

- C. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.
- D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Davis Colors.
    - b. Lanxess Corporation.
    - c. Solomon Colors, Inc.
    - d. Or Equal.
- E. Aggregate for Mortar: ASTM C 144.
  - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
  - 2. For joints less than 1/4-inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
  - 3. White-Mortar Aggregates: Natural white sand or crushed white stone.
  - 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- F. Aggregate for Grout: ASTM C 404.
- G. Water: Potable.

## **2.5 REINFORCEMENT**

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

## **2.6 MISCELLANEOUS MASONRY ACCESSORIES**

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

## **2.7 MORTAR AND GROUT MIXES**

- A. General: Do not use admixtures, including pigments, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
  - 1. Do not use calcium chloride in mortar or grout.
  - 2. Use portland cement-lime mortar unless otherwise indicated.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
  - 1. For masonry below grade or in contact with earth, use Type S.
  - 2. For reinforced masonry, use Type S.
  - 3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
  - 4. Provide minimum 28-day compressive strength as indicated on drawings.
  - 5. Limit cementitious materials in mortar to Portland cement and lime.
  - 6. Mortar unused for 1-1/2 hours from initial mix time shall not be used.
- C. Pigmented Mortar: Use colored cement product.
  - 1. Pigments shall not exceed 10 percent of Portland cement by weight.
  - 2. If pigments containing carbon black are used, carbon black must be limited to 2 percent of Portland cement by weight.
  - 3. Application: Use pigmented mortar for exposed mortar joints with the following units:
    - a. Where indicated.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
  - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
  - 2. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
  - 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

## **2.8 MASONRY CLEANERS**

- A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium poluphosphate and 1/2-cup dry measure laundry detergent dissolved in 1-gal. of water.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
  - 2. Verify that foundations are within tolerances specified.
  - 3. Verify that reinforcing dowels are properly placed.
  - 4. Verify that substrates are free of substances that would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION, GENERAL**

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- D. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

### **3.3 TOLERANCES**

- A. Dimensions and Locations of Elements:
  - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2-inch or minus 1/4-inch.
  - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2-inch.
  - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4-inch in a story height or 1/2-inch total.
- B. Lines and Levels:
  - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4-inch in 10 feet, or 1/2-inch maximum.
  - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do

not vary from level by more than 1/8-inch in 10 feet, 1/4-inch in 20 feet, or 1/2-inch maximum.

3. For vertical lines and surfaces do not vary from plumb by more than 1/4-inch in 10 feet, 3/8-inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8-inch in 10 feet, 1/4-inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4-inch in 10 feet, 3/8-inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4-inch in 10 feet, or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16-inch.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8-inch, with a maximum thickness limited to 1/2-inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8-inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8-inch or minus 1/4-inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8-inch.

### 3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

### **3.5 MORTAR BEDDING AND JOINTING**

- A. Lay hollow CMUs as follows:
  - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
  - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
  - 3. Bed webs in mortar, including starting course on footings.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- C. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

### **3.6 CONTROL AND EXPANSION JOINTS**

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry as follows:
  - 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.

### **3.7 REINFORCED UNIT MASONRY INSTALLATION**

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
  - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
  - 1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

### **3.8 FIELD QUALITY CONTROL**

- A. Testing and Inspecting: The District will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

### **3.9 REPAIRING, POINTING, AND CLEANING**

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain District Construction Manager's approval of sample cleaning before proceeding with cleaning of masonry.
  - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
  - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
  - 5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

### **END OF SECTION**



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

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Structural steel.
  - 2. Field-installed shear connectors.
  - 3. Grout.
- B. Related Requirements:
  - 1. Section 05 31 00 "Steel Decking" for field installation of shear connectors through deck.
  - 2. Section 05 50 00 "Metal Fabrications" for miscellaneous steel fabrications not defined as structural steel.
  - 3. Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting"

**1.2 DEFINITIONS**

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
- C. Heavy Sections: Rolled and built-up sections as follows:
  - 1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
  - 2. Welded built-up members with plates thicker than 2 inches.
  - 3. Column base plates thicker than 2 inches.
- D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
- E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

### **1.3 COORDINATION**

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication of structural-steel components.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Include embedment Drawings.
  - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
  - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
  - 5. Identify members and connections of the Seismic-Load-Resisting System.
  - 6. Indicate locations and dimensions of protected zones.
  - 7. Identify demand critical welds.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
  - 1. Power source (constant current or constant voltage).
  - 2. Electrode manufacturer and trade name, for demand critical welds.

### **1.5 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.
- B. Mill test reports for structural steel, including chemical and physical properties.

### **1.6 QUALITY ASSURANCE**

- A. Fabricator Qualifications: A qualified fabricator shall have a minimum of five years experience in similar types of fabrication, and one of the following:
  - 1.
  - 2. Participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- C. Comply with applicable provisions of the following specifications and documents:
  - 1. AISC 303.
  - 2. AISC 341 and AISC 341s1.
  - 3. AISC 360.
  - 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

## **1.7 REGULATORY REQUIREMENTS**

- A. Installer shall comply with California Fire Code Chapter 35 – Welding and Other Hot Work.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver structural steel to the Project Site in such quantities and at such times to ensure continuity of installation.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
  - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- C. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
  - 1. Fasteners may be repackaged provided District's testing and inspecting agency observes repackaging and seals containers.
  - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

## **PART 2 PRODUCTS**

### **2.1 STRUCTURAL-STEEL MATERIALS**

- A. W-Shapes: ASTM A992, Grade 50 or A572/A572M, Grade 50].
- B. Channels, Angles-Shapes: ASTM A 36/A 36M.

- C. Plate and Bar: ASTM A 36/A 36M or ASTM A 572/A 572M, Grade 50.
- D. Corrosion-Resisting Structural-Steel Shapes, Plates, and Bars: ASTM A 588/A 588M, Grade 50.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.
- F. Corrosion-Resisting, Cold-Formed Hollow Structural Sections: ASTM A 847/A 847M, structural tubing.
- G. Welding Electrodes: Comply with AWS requirements.

## **2.2 BOLTS, CONNECTORS, AND ANCHORS**

- A. Non-High-Strength Bolts, Nuts, and Washers: Provide unless otherwise noted. ASTM A 307, Grade A carbon-steel, hex-headed bolts, carbon-steel nuts, and flat, unhardened steel washers.
  - 1. Finish: Plain, uncoated or Hot-dip zinc-coating per ASTM A 153, Class C.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
  - 1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.
- C. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers with plain finish.
  - 1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type with plain finish.
- D. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
  - 1. Finish: Hot-dip zinc coating.
  - 2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.
- E. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex or round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
  - 1. Finish: Plain.
- F. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

- G. Unheaded Anchor Rods: ASTM F 1554, Grade 36 or ASTM A 572/A 572M, Grade 50.
  - 1. Configuration: Straight.
  - 2. Nuts: ASTM A 563 heavy-hex carbon steel.
  - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
  - 4. Washers: ASTM F 436, Type 1, hardened carbon steel.
  - 5. Finish: Plain.
- H. Headed Anchor Rods: ASTM F 1554, Grade 36 or ASTM F 1554, Grade 55, weldable, straight.
  - 1. Nuts: ASTM A 563 [heavy-]hex carbon steel.
  - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
  - 3. Washers: ASTM F 436, Type 1, hardened carbon steel.
  - 4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- I. Threaded Rods: ASTM A 36/A 36M.
  - 1. Nuts: ASTM A 563 heavy-hex carbon steel.
  - 2. Washers: ASTM F 436, Type 1, hardened or ASTM A 36/A 36M carbon steel.
  - 3. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- J. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.
- K. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

## **2.3 PRIMER**

- A. Primer: Comply with Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
- B. Primer: SSPC-Paint 25 Type II, zinc oxide, alkyd, linseed oil primer.
- C. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer compatible with topcoat.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds and repair painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight, and complying with ASTM A 780/A 780M.

## **2.4 GROUT**

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## 2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
  - 1. Camber structural-steel members where indicated.
  - 2. Fabricate beams with rolling camber up.
  - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
  - 4. Mark and match-mark materials for field assembly.
  - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
  - 6. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
- B. Fabricate architecturally exposed structural steel with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.
  - 1. Remove blemishes by filling, grinding, or by welding and grinding prior to cleaning, treating and shop priming.
  - 2. Comply with fabrication requirements, including tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel.
- C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- D. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning.", SSPC-SP 2, "Hand Tool Cleaning.", or SSPC-SP 3, "Power Tool Cleaning."
- G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- H. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.
- I. Welded Door Frames: Build up welded door frames attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws,

uniformly spaced not more than 10 inches o.c. unless otherwise indicated.

- J. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## **2.6 SHOP CONNECTIONS**

- A. Shop install and tighten non-high-strength bolts.
- B. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened, Pretensioned, or Slip critical.
- C. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.
  - 2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2-inch and larger. Grind flush butt welds. Dress exposed welds.

## **2.7 SHOP PRIMING**

- A. Shop prime steel surfaces except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  - 2. Surfaces to be field welded.
  - 3. Surfaces of high-strength bolted, slip-critical connections.
  - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
  - 5. Galvanized surfaces.
  - 6. Surfaces enclosed in interior construction.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
  - 1. SSPC-SP 2, "Hand Tool Cleaning."
  - 2. SSPC-SP 3, "Power Tool Cleaning."

- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
  - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

## **2.8 GALVANIZING**

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural-steel according to ASTM A 123/A 123M.
  - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
  - 2. Galvanize [lintels], [shelf angles], and [welded door frames] attached to structural-steel frame and located in exterior walls.

## **2.9 SOURCE QUALITY CONTROL**

- A. Testing Agency: The District will engage a qualified testing agency to perform shop tests and inspections.
  - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
  - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when



permanent structural steel, connections, and bracing are in place unless otherwise indicated.

### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Weld plate washers to top of baseplate.
  - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Maintain erection tolerances of architecturally exposed structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- E. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- F. Splice members only where indicated.
- G. Do not use thermal cutting during erection unless approved by the District Construction Manager. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
  - 1. Finish sections thermally cut during erection equal to a sheared appearance.
- H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- I. Remove erection bolts on welded, architecturally exposed structural steel. Fill holes with plug welds, and grind smooth at exposed surfaces.
- J. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors

according to AWS D1.1/D1.1M and manufacturer's written instructions.

### **3.4 FIELD CONNECTIONS**

- A. Non-high-strength bolts: Install and tighten non-high-strength bolts, except where high-strength bolts are indicated.
- B. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened and Pretensioned.
- C. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  - 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
  - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.
  - 4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2-inch and larger. Grind flush butt welds. Dress exposed welds.

### **3.5 FIELD QUALITY CONTROL**

- A. Special Inspections: The District will engage a qualified special inspector to perform the following special inspections:
  - 1. Verify structural-steel materials and inspect steel frame joint details.
  - 2. Verify weld materials and inspect welds.
  - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: The District will engage a qualified testing agency to perform tests.
- C. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

### **3.6 REPAIRS AND PROTECTION**

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.

- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- C. Touchup Painting: Cleaning and touchup painting are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

**END OF SECTION**

## **SECTION 05 31 00**

### **STEEL DECKING**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Roof deck.
- B. Related Requirements:
  - 1. Section 09 91 13 "Exterior Painting" for repair painting of primed deck and finish painting of deck.

##### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings:
  - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

##### **1.3 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.

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

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

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

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

#### **PART 2 PRODUCTS**

##### **2.1 PERFORMANCE REQUIREMENTS**

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck

according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

## **2.2 ROOF DECK**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ASC Profiles, Inc.
  - 2. Nucor Corp.
  - 3. Verco Decking, Inc., a Nucor company.
  - 4. Or Equal.
- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
  - 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 G60
  - 2. Deck Profile: As indicated.
  - 3. Profile Depth: As indicated.
  - 4. Design Uncoated-Steel Thickness: As indicated.
  - 5. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
  - 6. Span Condition: As indicated.
  - 7. Side Laps: Interlocking seam.

## **2.3 ACCESSORIES**

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- C. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- E. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- F. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- G. Shear Connectors: ASTM A 108, Grades 1010 through 1020 headed stud type, cold-finished carbon steel, AWS D1.1, Type B, with arc shields.
- H. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION, GENERAL**

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
  - 1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

### **3.3 ROOF-DECK INSTALLATION**

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
  - 1. Weld Diameter: [1-inch visual (1/2-inch effective)], nominal.
  - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
  - 3. Weld Washers: Install weld washers at each weld location.

- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or [18 inches] and [36 inches], and as follows:
  - 1. Fasten with a minimum of 1-1/2-inch- long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
  - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches apart with at least one weld at each corner.
  - 1. Install reinforcing channels or zees in ribs to span between supports and weld.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.
  - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.
- G. Sound-Absorbing Insulation: Installation into topside ribs of acoustical roof deck as specified in Section "<Insert title of applicable roofing Section>."

### **3.4 FIELD QUALITY CONTROL**

- A. Testing Agency: The District will engage a qualified testing agency to perform tests and inspections.
- B. Remove and replace work that does not comply with specified requirements.

### **3.5 PROTECTION**

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.
- C.

**END OF SECTION**

**SECTION 05 50 00**  
**METAL FABRICATIONS**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Steel framing and supports for countertops.
  - 2. Steel tube reinforcement for low partitions.
  - 3. Steel framing and supports for mechanical and electrical equipment.
  - 4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
  - 5. Metal ladders.
  - 6. Metal bollards.
- B. Related Requirements:
  - 1. Section 03 30 00 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
  - 2. Section 04 22 00 "Concrete Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
  - 3. Section 05 12 00 "Structural Steel Framing."

**1.3 COORDINATION**

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.



## **1.4 ACTION SUBMITTALS**

- A. Product Data: For the following:
  - 1. Pre-fabricated roof ladders.
  - 2. Pre-fabricated countertop supports.
  - 3. Fasteners.
  - 4. Shop Primers.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
  - 1. Steel tube reinforcement for low partitions.
  - 2. Steel framing and supports for mechanical and electrical equipment.
  - 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
  - 4. Metal ladders.
  - 5. Metal ships' ladders.
  - 6. Metal bollards.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For professional engineer.
- B. Welding certificates.

## **1.6 QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
  - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

## **1.7 FIELD CONDITIONS**

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

# **PART 2 PRODUCTS**

## **2.1 PERFORMANCE REQUIREMENTS**

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## **2.2 METALS**

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304 and Type 316L.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- E. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- G. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- H. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- I. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- J. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

## **2.3 FASTENERS**

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
  - 1. Provide stainless-steel fasteners for fastening aluminum.
  - 2. Provide stainless-steel fasteners for fastening stainless steel.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.
- D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
  - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

- F. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- G. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
  - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- H. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8-by-7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

## **2.4 MISCELLANEOUS MATERIALS.**

- A. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting." and Section 09 91 23 Interior Painting."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer and compatible with topcoat.
  - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Epoxy Zinc-Rich Primer: Compatible with topcoat.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Carboline Company.
    - b. PPG Paints.
    - c. Rust-Oleum.
    - d. Sherwin-Williams Company.
    - e. Or Equal.
- D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- H. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength

of 3000 psi.

## **2.5 FABRICATION, GENERAL**

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32-inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8-by-1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## **2.6 MISCELLANEOUS FRAMING AND SUPPORTS**

- A. General: Provide steel framing and supports not specified in other Sections as

needed to complete the Work.

- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
  - 1. Fabricate units from slotted channel framing where indicated.
  - 2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

## **2.7 METAL LADDERS**

- A. General:
  - 1. Comply with ANSI A14.3.
- B. Steel Ladders:
  - 1. Space siderails 16 inches apart unless otherwise indicated.
  - 2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
  - 3. Rungs: 3/4-inch-square steel bars.
  - 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
  - 5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
  - 6. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) ALGRIP.
      - 2) Harsco Industrial IKG, a division of Harsco Corporation.
      - 3) SlipNOT Metal Safety Flooring; W.S. Molnar Company.
      - 4) Or Equal.
  - 7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
  - 8. Prime interior ladders, where indicated including brackets and fasteners, with zinc-rich primer.

## **2.8 MISCELLANEOUS STEEL TRIM**

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
  - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize exterior miscellaneous steel trim where indicated.

- D. Prime interior and exterior miscellaneous steel trim with zinc-rich primer where indicated.

## **2.9 METAL BOLLARDS**

- A. Fabricate metal bollards from Schedule 40 steel pipe.
  - 1. Cap bollards with 1/4-inch-thick steel plate.
  - 2. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
  - 3. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.
- B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch-thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4-inch larger than OD of bollard.
- C. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch wall-thickness steel tubing with an OD approximately 1/16-inch less than ID of bollards. Match drill sleeve and bollard for 3/4-inch steel machine bolt.
- D. Galvanize metal bollards and sleeves after fabrication.
- E. Fabricate bollards to meet P1 penetration rating per ASTM F3016.

## **2.10 STEEL WELD PLATES AND ANGLES**

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

## **2.11 FINISHES, GENERAL**

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

## **2.12 STEEL AND IRON FINISHES**

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
  - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - 1. Shop prime with universal shop primer.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
  - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 3. Other Items: SSPC-SP 3, "Power Tool Cleaning."

## **2.13 ALUMINUM FINISHES**

- A. As-Fabricated Finish: AA-M12.
- B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
  - 1. Cast Aluminum: Heavy coat of bituminous paint.
  - 2. Extruded Aluminum: Two coats of clear lacquer.

### **3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS**

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for overhead doors securely to, and rigidly brace from, building structure.
- C. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
  - 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

### **3.3 INSTALLING METAL BOLLARDS**

- A. Anchor bollards in concrete. Fill annular space around bollard solidly with nonshrink grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8-inch toward bollard.
- B. Anchor internal sleeves for removable bollards in concrete by inserting in pipe sleeves preset into concrete. Fill annular space around internal sleeves solidly with nonshrink grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8-inch toward internal sleeve.
- C. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.
- D. Place removable bollards over internal sleeves and secure with 3/4-inch machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. The District furnishes padlocks.
- E. Fill bollards solidly with concrete, mounding top surface to shed water.
  - 1. Do not fill removable bollards with concrete.

### **3.4 ADJUSTING AND CLEANING**

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.



- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting." and Section 09 91 23 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

**END OF SECTION**

**SECTION 06 10 00**  
**ROUGH CARPENTRY**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Framing with dimension lumber.
  - 2. Framing with timber.
  - 3. Framing with engineered wood products.
  - 4. Shear wall panels.
  - 5. Rooftop equipment bases and support curbs.
  - 6. Wood blocking and nailers.
  - 7. Wood sleepers.
  - 8. Plywood backing panels.

**PART 2 PRODUCTS**

**2.1 WOOD PRODUCTS, GENERAL**

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
  - 3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent.
- C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current ICC-ES research or evaluation reports exist that show compliance with CBC.
  - 1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

## **2.2 WOOD-PRESERVATIVE-TREATED LUMBER**

- A. Preservative Treatment by Pressure Process: AWP U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
  - 2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
  - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- D. Application: Pressure treat above ground items with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat items indicated on Drawings, and the following:
  - 1. Wood nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, and waterproofing.
  - 2. Wood sills, sleepers, blocking, furring, and stripping, and similar concealed members in contact with masonry or concrete.
  - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
  - 4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
  - 5. Wood floor plates that are installed over concrete slabs-on-grade.

## **2.3 FIRE-RETARDANT-TREATED MATERIALS**

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  - 1. Treatment shall not promote corrosion of metal fasteners.

2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
  3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
  4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- D. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.
- E. Application: Treat items indicated on Drawings, and the following:
1. Plywood backing panels indicated on drawings.

## **2.4 DIMENSION LUMBER FRAMING**

- A. Non-Load-Bearing Interior Partitions: No.1 grade.
1. Application: Interior partitions not indicated as load bearing.
  2. Species:
    - a. Douglas fir-larch; WCLIB, or WWPA.
- B. Load-Bearing Partitions: No. 1 grade.
1. Application: Exterior walls and interior load-bearing partitions.
  2. Species:
    - a. Douglas fir-larch; WCLIB or WWPA.
- C. Ceiling Joists: No. 1 grade.
1. Species:
    - a. Douglas fir-larch; WCLIB or WWPA.
- D. Joists, Rafters, and Other Framing Not Listed Above: No. 1 grade.
1. Species:
    - a. Douglas fir-larch; WCLIB or WWPA.
- E. Exposed Framing Indicated to Receive a Stained or Natural Finish: Hand-select material for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
1. Species and Grade: As indicated above for load-bearing construction of same type.

## **2.5 TIMBER FRAMING**

- A. Comply with the following requirements, according to grading rules of grading agency indicated:
  - 1. Species and Grade: Douglas fir-larch, or Douglas fir-south; No. 1 grade; WCLIB, or WWPA.
  - 2. Maximum Moisture Content: 20 percent.
  - 3. Additional Restriction: Free of heart centers.

## **2.6 ENGINEERED WOOD PRODUCTS**

- A. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.
- B. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. RedBuilt, LLC.
    - b. Boise Cascade Corporation.
    - c. Louisiana-Pacific Corporation.
    - d. Weyerhaeuser Company.
    - e. Or Equal.
  - 2. Extreme Fiber Stress in Bending, Edgewise: 2900 psi for 12-inch nominal-depth members.
  - 3. Modulus of Elasticity, Edgewise: 2,000,000 psi.
- C. Wood I-Joists: Prefabricated units, I-shaped in cross section, made with solid or structural composite lumber flanges and wood-based structural panel webs, let into and bonded to flanges. Comply with material requirements of and with structural capacities established and monitored according to ASTM D 5055.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. RedBuilt, LLC.
    - b. Boise Cascade Corporation.
    - c. Louisiana-Pacific Corporation.
    - d. Weyerhaeuser Company.
    - e. Or Equal.
  - 2. Web Material: Either OSB or plywood, complying with DOC PS 1 or DOC PS 2, Exposure 1.
  - 3. Structural Properties: Depths and design values not less than those indicated.
  - 4. Comply with APA PRI-400. Factory mark I-joists with APA-EWS trademark indicating nominal joist depth, joist class, span ratings, mill identification, and compliance with APA-EWS standard.

- D. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research or evaluation report for I-joists.
  - 1. Manufacturer: Provide products by same manufacturer as I-joists.
  - 2. Material: All-veneer product.
  - 3. Thickness: 1-1/2 inches or 1-3/4 inches.
  - 4. Comply with APA PRR-401, rim board grade. Factory mark rim boards with APA-EWS trademark indicating thickness, grade, and compliance with APA-EWS standard.

## **2.7 SHEAR WALL PANELS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Shear Transfer Systems.
  - 2. Simpson Strong-Tie Co., Inc.
  - 3. Weyerhaeuser Company.
  - 4. Or Equal.
- B. Wood-Framed Shear Wall Panels: Prefabricated assembly consisting of wood perimeter framing, tie downs, and Exposure I, Structural I plywood sheathing.
- C. Steel-Framed Shear Wall Panels: Prefabricated assembly consisting of cold-formed galvanized-steel panel, steel top and bottom plates, and wood studs.
- D. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

## **2.8 MISCELLANEOUS LUMBER**

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Rooftop equipment bases and support curbs.
  - 4. Furring.
  - 5. Grounds.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of the following species:
  - 1. Douglas fir-larch; WCLIB, or WWPA.
- C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:
  - 1. Douglas fir-larch; Construction or No. 2 Common grade; WCLIB, or WWPA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to

eliminate defects that will interfere with its attachment and purpose.

- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

## **2.9 PLYWOOD BACKING PANELS**

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

## **2.10 FASTENERS**

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
  - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.
  - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
  - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.
- E. Wood Screws: ASME B18.6.1.
- 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.

## **2.11 MISCELLANEOUS MATERIALS**

- A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4-inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025-inch.
- C. Adhesives for Gluing to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
- D. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Install shear wall panels to comply with manufacturer's written instructions.
- F. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- G. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- H. Do not splice structural members between supports unless otherwise indicated.
- I. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- J. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
  - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more



- than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
  3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
- K. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- L. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
1. Use inorganic boron for items that are continuously protected from liquid water.
  2. Use copper naphthenate for items not continuously protected from liquid water.
- M. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- N. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
1. Table 2304.9.1, "Fastening Schedule," in the California Building Code (CBC).
  2. ICC-ES evaluation report for fastener.
- O. Use steel common 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. Drive nails snug but do not countersink nail heads unless otherwise indicated.
- P. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
1. Comply with approved fastener patterns where applicable.
  2. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

### **3.2 WOOD BLOCKING, AND NAILER INSTALLATION**

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, 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.

### **3.4 WALL AND PARTITION FRAMING INSTALLATION**

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.
  - 1. For exterior walls, provide 2-by-6-inch nominal- size wood studs spaced 16 inches o.c. unless otherwise indicated.
  - 2. For interior partitions and walls, provide 2-by-4-inch nominal- size wood studs spaced 16 inches o.c. unless otherwise indicated.
  - 3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.
- B. Construct corners and intersections with three or more studs.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
  - 1. For non-load-bearing partitions, provide double-jamb studs and headers at all openings, sized not less than as follows:
    - a. 4-inch nominal depth for openings 48 inches and less in width
    - b. 6-inch nominal depth for openings 48 to 72 inches in width
    - c. 8-inch nominal depth for openings 72 to 120 inches in width
    - d. 10-inch nominal depth for openings 10 to 12 feet in width.
  - 2. For load-bearing walls, provide double-jamb studs and headers at all openings, sized not less than as follows:
    - a. 60 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated.
  - 3. For load-bearing walls, provide triple-jamb studs and headers at all openings wider than 60 inches.

### **3.5 CEILING JOIST AND RAFTER FRAMING INSTALLATION**

- A. Ceiling Joists: Install with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
  - 1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate, and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal-size or 2-by-4-inch nominal-size stringers spaced 48 inches o.c. crosswise over main ceiling joists.

- B. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
  - 1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.
  - 2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.
- C. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal-size boards between every third pair of rafters, but not more than 48 inches o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.
- D. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

#### **END OF SECTION**

## **SECTION 06 41 13**

### **WOOD-VENEER-FACED ARCHITECTURAL CABINETS**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Wood-veneer-faced architectural cabinets.
  - 2. Wood furring, blocking, shims, and hanging strips for installing architectural cabinets that are not concealed within other construction.
  - 3. Shop finishing of architectural cabinets.
- B. Related Requirements:
  - 1. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
  - 2. Section 06 41 16 "Plastic-Laminate-Clad Architectural Cabinets".
  - 3. Section 12 36 23.13 "Plastic-Laminate-Clad Countertops".

##### **1.3 DEFINITIONS**

- A. AWS: "Architectural Woodwork Standards", adopted and published jointly by AWI, AWMAC, and WI.

##### **1.4 COORDINATION**

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

##### **1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product, including, panel products, cabinet hardware and accessories, and finishing materials and processes.

- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment details and devices, and other related components.
  - 1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
  - 2. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural wood cabinets.
  - 3. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
  - 4. Apply WI Certified Compliance Program label to Shop Drawings.
- C. Keying Schedule: Include schematic keying diagram, and index each key set to unique designations that are coordinated with the Contract Documents.
- D. Samples for Initial Selection: For each type of exposed finish, including shop-applied transparent finishes.
- E. Samples for Verification:
  - 1. Lumber for transparent finish, not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
  - 2. Veneer leaves representative of and selected from flitches to be used for transparent-finished cabinets.
  - 3. Corner Pieces:
    - a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
    - b. Miter joints for standing trim.
  - 4. Exposed cabinet hardware and accessories, one unit for each type and finish.

## **1.6 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Fabricator/Installer.
- B. Product Certificates: For the following:
  - 1. Composite wood and agrifiber products.
  - 2. Adhesives.
- C. Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.
- D. At Substantial Completion, provide WI Certificate of Compliance for all casework and materials installed.

## **1.7 QUALITY ASSURANCE**

- A. Work shall be done in accordance with AWS for the grades specified.
- B. Fabricator/Installer Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have

a five year record of successful in-service performance. WI compliance certification is required. WI will inspect work and provide certification for work that passes inspection if fabricator is not certified/licensed.

- C. Certified Compliance:
  - 1. Provide a WI Certificate of Compliance indicating that all casework meets the requirements of the AWS, the plans and specifications.
  - 2. Apply a WI Certificate of Compliance Label to each section of casework and to each counter top.
  - 3. On completion of installation, provide a WI Certified Compliance Certificate for the installation.
  - 4. All WI Certified Compliance fees are the responsibility of the casework manufacturer.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

## **1.9 FIELD CONDITIONS**

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed or concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain work described in this Section from single source from single manufacturer unless otherwise indicated.

## **2.2 ARCHITECTURAL WOOD CABINETS, GENERAL**

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural cabinets indicated for construction, finishes, installation, and other requirements.

## **2.3 WOOD CABINETS FOR TRANSPARENT FINISH**

- A. Grade: Custom with exceptions noted herein.
- B. Type of Construction: Style A, Frameless.
- C. Cabinet and Door and Drawer Front Interface Style: Flush overlay.
- D. Reveal Dimension: 1/8-inch.
- E. Wood for Exposed Surfaces:
  - 1. Species: White birch.
  - 2. Cut: Plain sliced/plain sawn.
  - 3. Grain Direction: Vertically for doors and fixed panels, horizontally for drawer fronts.
  - 4. Matching of Veneer Leaves: Random match.
- F. Semiexposed Surfaces: Provide surface materials indicated below:
  - 1. Surfaces Other Than Drawer Bodies: Compatible species to that indicated for exposed surfaces stained to match.
  - 2. Drawer Subfronts, Backs, and Sides: Solid-hardwood lumber.
  - 3. Drawer Bottoms: Hardwood plywood.
- G. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
  - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.

## **2.4 WOOD MATERIALS**

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
  - 1. Wood Moisture Content: 4 to 9 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
  - 1. Softwood Plywood: DOC PS 1.
  - 2. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
  - 3. Core Material at Cabinet Body
    - a. Exterior veneer core plywood.

- b. Particleboard is not permitted for use as core material.

## **2.5 CABINET HARDWARE AND ACCESSORIES**

- A. Finish: US-26D finish (satin chrome).
- B. Locks: Olympus 700/800 Series Schlage keyway desk/drawer locks, 626 finish. Door & Drawer Lock: Schlage 46002 with strike.
  - 1. Cabinet locks shall be alike per area or room. All cabinet doors and drawers to have locks and master keyed.
- C. Hinges: Rockford B-851, 54 - 57. Heavy-duty, wrap around, tight pin butts of steel, 2-1/2" minimum width, offset for overlay doors installed with #8 full thread screws, minimum (4) to jamb and (4) to door, per Grade 1 Standards.
- D. Drawer & Door Pulls: Amerock Model #BP3053526D Brushed Chrome Cabinet Pull.
- E. Sliding door hardware for 3/4" door shall be Acme #8900, Grant 6005 or equal.
- F. Drawer Guides:
  - 1. Pencil Drawers: 50 lb. Full extension, Krona-Flex 50 lb. capacity; HDI; Grant; or equal, KV1428, KV1429 and KV1400P or Grant 5632.
  - 2. All other drawers - Ball-bearing, 100 lb. load capacity; Blum BS230.
  - 3. File Drawers - Accuride 417. File drawers full extension, 150 lb. capacity
- G. File Folders: For letter Size: Hardware Specialty No. 1485-FWZ; National 61-08 (291); Mark V Enterprises No.291; KV 476; or equal.
- H. Countertop Shelf Bracket: KV Ultimate L-bracket 208WH 550 (21.7" long).
- I. Cable Hooks: B-Line model #BCH32; galvanized with Qwik-latch cable retainer BCHR32.
  - 1. Clarification: Provide 2 cable hooks at each 3'-0" knee space.
- J. Piano Hinge: National, Parker.
- K. Adjustable Shelf Standard ( Double-Slotted ): KV 85; or equal, or provide 5 mm bored holes on 32 mm centers with Hafele HA282.11.707 or HA282.25.710.01 nickel shelf clips.
- L. Adjustable Shelf Brackets ( Double ): KV 185; or equal, or provide 5 mm bored holes on 32 mm centers with Hafele HA282.11.707 or HA282.25.710.01 nickel shelf clips.
- M. Cabinet Shelf Support (one of the types below):
  - 1. Shelf Support - Hettich "Sekura" Model #50-016-721. This piece must be approved by D.S.A.
- N. Grommet: Plastic hole covers, Haefle.



- O. Key Separators - Tag "Deliver to Job with Keys in Lock ".
- P. Wardrobe Tubing Pole - KV770-5.
  - 1. Tubing KV 660SS.
  - 2. Flanges KV 734CHR.

## **2.6 MISCELLANEOUS MATERIALS**

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

## **2.7 FABRICATION**

- A. Fabrication shall comply with AWS requirements.
- B. Fabricate architectural cabinets to dimensions, profiles, and details indicated. Ease edges and corners to 1/16-inch radius unless otherwise indicated.
- C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

## **2.8 SHOP FINISHING**

- A. General: Finish architectural cabinets at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural cabinets, as applicable to each unit of work.
  - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of cabinets.

- C. Cabinet Finish: Clear Lacquer finish
  - 1. Field Applied: Chemcraft - Chemseal 550 (546-1227SPB) and Chemlack High Gloss (441-2790SPB)
  - 2. Factory Applied: Water based acrylic lacquer

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas for not less than 72 hours.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required. Remove packing materials.

### **3.2 INSTALLATION**

- A. Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Install casework in conformance with the latest edition of the AWS.
- C. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- D. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8-inch in 96 inches.
- E. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- F. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with cabinet surface.
  - 1. Use filler matching finish of items being installed.
- G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 1. Install cabinets with no more than 1/8-inch in 96-inch sag, bow, or other variation from a straight line.
  - 2. Maintain veneer sequence matching of cabinets with transparent finish.
  - 3. Fasten wall cabinets to walls as indicated on Drawings.

- H. Touch up finishing work specified in this Section after installation of architectural cabinets. Fill nail holes with matching filler where exposed.
  - 1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.

### **3.3 ADJUSTING AND CLEANING**

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces. Touch up finishes to restore damaged or soiled areas.

**END OF SECTION**

## **SECTION 06 41 16**

### **PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Plastic-laminate-faced architectural cabinets.
  - 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets that are not concealed within other construction.
- B. Related Requirements:
  - 1. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
  - 2. Section 06 41 13 "Wood Veneer Faced Architectural Cabinets".
  - 3. Section 12 36 23.13 "Plastic-Laminate-Clad Countertops."

##### **1.3 DEFINITIONS**

- A. AWS: "Architectural Woodwork Standards", adopted and published jointly by AWI, AWMAC, and WI.

##### **1.4 COORDINATION**

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.
- B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 08 71 00 "Door Hardware" to fabricator of architectural cabinets; coordinate Shop Drawings and fabrication with hardware requirements.

##### **1.5 ACTION SUBMITTALS**

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

- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other related components.
  - 1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
  - 2. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
  - 3. Apply WI Certified Compliance Program label to Shop Drawings.
- C. Keying Schedule: Include schematic keying diagram, and index each key set to unique designations that are coordinated with the Contract Documents.
- D. Samples for Initial Selection: For each type of exposed finish.
- E. Samples for Verification:
  - 1. Plastic laminates, 12-by-12 inches, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
  - 2. Wood-grain plastic laminates, 12-by-24 inches, for each type, pattern and surface finish, with one sample applied to core material and specified edge material applied to one edge.
  - 3. Corner pieces as follows:
    - a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
    - b. Miter joints for standing trim.
  - 4. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

## **1.6 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Fabricator/Installer.
- B. Product Certificates: For the following:
  - 1. Composite wood and agrifiber products.
  - 2. High-pressure decorative laminate.
  - 3. Adhesives.
- C. Woodwork Quality Standard Compliance Certificates: WI Certified Compliance Program.
- D. At Substantial Completion, provide WI Certificate of Compliance for all casework and materials installed.

## **1.7 QUALITY ASSURANCE**

- A. Work shall be done in accordance with AWS for the grades specified.
- B. Fabricator/Installer Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have

a five year record of successful in-service performance. WI compliance certification is required. WI will inspect work and provide certification for work that passes inspection if fabricator is not certified/licensed.

- C. Certified Compliance:
  - 1. Provide a WI Certificate of Compliance indicating that all casework meets the requirements of the AWS, the plans and specifications.
  - 2. Apply a WI Certificate of Compliance Label to each section of casework.
  - 3. On completion of installation, provide a WI Certified Compliance Certificate for the installation.
  - 4. All WI Certified Compliance fees are the responsibility of the casework manufacturer.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Do not deliver cabinets until painting and similar operations that might damage architectural cabinets have been completed in installation areas. Store cabinets only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

## **1.9 FIELD CONDITIONS**

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed or concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain work described in this Section from single source from single manufacturer unless otherwise indicated.

## 2.2 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of cabinets indicated for construction, finishes, installation, and other requirements.
  - 1. Provide labels and certificates from WI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
- B. Grade: Custom with exceptions noted herein.
- C. Type of Construction: Style A, Frameless.
- D. Door and Drawer Front Style: Flush overlay.
- E. Reveal Dimension: 1/8 inch.
- F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Formica Corporation.
    - b. Nevamar Company, LLC; Decorative Products Div.
    - c. Wilsonart LLC.
    - d. Or Equal.
- G. Core Material at Cabinet Body
  - 1. MDF or Particleboard meeting the requirements of North American Architectural Woodwork Standards.
    - a. Made with no added urea formaldehyde, CARB compliant.
    - b. Water-resistant core, where required: Particle board meeting the requirements of ANSI A208.1 Grade M3 MR-50 or MDF meeting the requirements of ANSI A 208.2 Grade 155 MR-50.
- H. Laminate Cladding for Exposed Surfaces:
  - 1. Horizontal Surfaces: Grade HGS.
  - 2. Vertical Surfaces: Grade VGS.
  - 3. Edges: Grade HGS.
  - 4. Pattern Direction: Vertically for doors and fixed panels, horizontally for drawer fronts.
- I. Materials for Semiexposed Surfaces:
  - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
    - a. Edges of Plastic-Laminate Shelves: PVC T-mold matching laminate in color, pattern, and finish.
    - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade CLS.
  - 2. Drawer Sides and Backs: Solid-hardwood lumber.
  - 3. Drawer Bottoms: Hardwood plywood.

- J. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- K. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
  - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.
- L. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. As selected by Architect from laminate manufacturer's full range in the following categories:
    - a. Wood grains, matte finish.
- M. Plastic-Laminate Shelves:
  - 1. Plastic-Laminate Shelves: Plastic laminate shop bonded to both faces and all edges of 1-inch-thick core. Sand surfaces to which plastic laminate is to be bonded.
    - a. Shelf Core: Exterior plywood.
    - b. Plastic-Laminate Grade for Shelves: HGL.

## **2.3 WOOD MATERIALS**

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
  - 1. Wood Moisture Content: 4 to 9 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
  - 1. Softwood Plywood: DOC PS 1.
  - 2. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

## **2.4 CABINET HARDWARE AND ACCESSORIES**

- A. Finish: US-26D finish (satin chrome).
- B. Locks: Olympus 700/800 Series Schlage keyway desk/drawer locks, 626 finish. Door & Drawer Lock: Schlage 46002 with strike.
  - 1. Cabinet locks shall be alike per area or room. All cabinet doors and drawers to have locks and master keyed.
- C. Hinges: Rockford B-851, 54 - 57. Heavy-duty, wrap around, tight pin butts of steel, 2-1/2" minimum width, offset for overlay doors installed with #8 full thread screws, minimum (4) to jamb and (4) to door, per Grade 1 Standards.
- D. Drawer & Door Pulls: Amerock Model #BP3053526D Brushed Chrome Cabinet Pull.



- E. Sliding door hardware for  $\frac{3}{4}$ " door shall be Acme #8900, Grant 6005 or equal.
- F. Drawer Guides:
  - 1. Pencil Drawers: 50 lb. Full extension, Krona-Flex 50 lb. capacity; HDI; Grant; or equal, KV1428, KV1429 and KV1400P or Grant 5632.
  - 2. All other drawers - Ball-bearing, 100 lb. load capacity; Blum BS230.
  - 3. File Drawers - Accuride 417. File drawers full extension, 150 lb. capacity
- G. File Folders: For letter Size: Hardware Specialty No. 1485-FWZ; National 61-08 (291); Mark V Enterprises No.291; KV 476; or equal.
- H. Countertop Shelf Bracket: KV Ultimate L-bracket 208WH 550 (21.7" long).
- I. Cable Hooks: B-Line model #BCH32; galvanized with Qwik-latch cable retainer BCHR32.
  - 1. Clarification: Provide 2 cable hooks at each 3'-0" knee space.
- J. Piano Hinge: National, Parker.
- K. Adjustable Shelf Standard ( Double-Slotted ): KV 85; or equal, or provide 5 mm bored holes on 32 mm centers with Hafele HA282.11.707 or HA282.25.710.01 nickel shelf clips.
- L. Adjustable Shelf Brackets ( Double ): KV 185; or equal, or provide 5 mm bored holes on 32 mm centers with Hafele HA282.11.707 or HA282.25.710.01 nickel shelf clips.
- M. Cabinet Shelf Support (one of the types below):
  - 1. Shelf Support - Hettich "Sekura" Model #50-016-721. This piece must be approved by D.S.A.
- N. Grommet: Plastic hole covers, Haefle.
- O. Key Separators - Tag "Deliver to Job with Keys in Lock ".
- P. Wardrobe Tubing Pole - KV770-5.
  - 1. Tubing KV 660SS.
  - 2. Flanges KV 734CHR.

## **2.5 MISCELLANEOUS MATERIALS**

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

- C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
  - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

## **2.6 FABRICATION**

- A. Fabrication shall comply with AWS requirements.
- B. Fabricate architectural cabinets to dimensions, profiles, and details indicated.
- C. Complete fabrication, including assembly, finishing and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
- E. Install glass to comply with applicable requirements in Section 08 80 00 "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas for not less than 72 hours.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required. Remove packing materials.

### **3.2 INSTALLATION**

- A. Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Install casework in conformance with the latest edition of the AWS.
- C. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

- D. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8-inch in 96 inches.
- E. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- F. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with cabinet surface.
  - 1. Use filler matching finish of items being installed.
- G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 1. Install cabinets with no more than 1/8-inch in 96-inch sag, bow, or other variation from a straight line.
  - 2. Fasten wall cabinets to walls as indicated on Drawings.

### **3.3 ADJUSTING AND CLEANING**

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

### **END OF SECTION**

## **SECTION 06 64 00**

### **PLASTIC PANELING**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Plastic sheet paneling.
- B. Related Requirements:
  - 1. Section 06 10 00 "Rough Carpentry" for wood furring for installing plastic paneling.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

##### **1.4 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

#### **PART 2 PRODUCTS**

##### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

## **2.2 PLASTIC SHEET PANELING**

- A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Composites, Inc.
    - b. Marlite.
    - c. Nudo Products, Inc.
    - d. Or Equal.
  - 2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 450 or less.
  - 3. Nominal Thickness: Not less than 0.09-inch.
  - 4. Surface Finish: As selected by Architect from manufacturer's full range.
  - 5. Color: As selected by Architect from manufacturer's full range.

## **2.3 ACCESSORIES**

- A. Trim Accessories: Manufacturer's standard two-piece, snap-on vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
  - 1. Color: As selected by Architect from manufacturer's full range.
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Adhesive: As recommended by plastic paneling manufacturer.
  - 1. Adhesive shall comply with the testing and product requirements of San Diego Air Pollution Control District Rule 67.0 "Architectural Coatings" and Rule 67.21 "Adhesive Material Application Operations."
- D. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 92 00 "Joint Sealants."
  - 1. Sealant shall comply with the testing and product requirements of San Diego Air Pollution Control District Rule 67.0 "Architectural Coatings" and Rule 67.21 "Adhesive Material Application Operations."

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- E. Lay out paneling before installing. Locate panel joints so that trimmed panels at corners are not less than 12 inches wide.
  - 1. Mark plumb lines on substrate at trim accessory locations for accurate installation.
  - 2. Locate trim accessories and panel joints to allow clearance at panel edges according to manufacturer's written instructions.

### **3.3 INSTALLATION**

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install trim accessories with adhesive, nails, and staples. Do not fasten through panels.
- D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

- E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

**END OF SECTION**

**SECTION 07 21 00**  
**THERMAL INSULATION**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Glass-fiber blanket.

**1.3 ACTION SUBMITTALS**

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

**1.4 INFORMATIONAL SUBMITTALS**

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

**1.5 DELIVERY, STORAGE, AND HANDLING**

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

**PART 2 PRODUCTS**

**2.1 GLASS-FIBER BLANKET**

- A. Faced Glass-Fiber Blankets: ASTM C665, vapor-retarding.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CertainTeed Corporation.
    - b. Johns Manville; a Berkshire Hathaway company.
    - c. Owens Corning.



- d. Or Equal.
- 2. Facing: One side, Kraft.
- 3. Surface Burning Characteristics: ASTM E84.
  - a. Flame Spread Index: 25, maximum.
- B. Glass-Fiber Blanket, Unfaced <Insert drawing designation>: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CertainTeed Corporation.
    - b. Johns Manville; a Berkshire Hathaway company.
    - c. Owens Corning.
    - d. Or Equal.

## 2.2 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AGM Industries, Inc.
    - b. Cal-Fasteners, Inc.
    - c. Integrity Fasteners, Inc.
    - d. Or Equal.
  - 2. Plate: Perforated, galvanized carbon-steel sheet, 0.030-inch thick by 2 inches square.
  - 3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. AGM Industries, Inc.
    - b. Cal-Fasteners, Inc.
    - c. Integrity Fasteners, Inc.
    - d. Or Equal.
  - 2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
    - a. Crawl spaces.
    - b. Ceiling plenums.
    - c. Attic spaces.
- C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by

one of the following:

- a. AGM Industries, Inc.
- b. Cal-Fasteners, Inc.
- c. Gemco.
- d. Or Equal.

## **2.3 ACCESSORIES**

- A. Insulation for Miscellaneous Voids:
  - 1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

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

### **3.2 INSTALLATION, GENERAL**

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

### **3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION**

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths

- that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
  4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
  5. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
    - a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
  6. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
    - a. Exterior Walls: Set units with facing placed toward interior of construction.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.

### **3.4 PROTECTION**

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

### **END OF SECTION**

**SECTION 07 25 00**  
**WEATHER BARRIERS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Building wrap at cement plaster.
  - 2. Building wrap
  - 3. Flexible Flashing
  - 4. Sealant or Liquid Applied Flashing.

**1.2 ACTION SUBMITTALS**

- A. Product Data:
  - 1. For each type of product.
- B. Product Data Submittals: For building wraps, include data on air and water-vapor permeance based on testing in accordance with referenced standards.
- C. Shop Drawings: Show details of building wrap at terminations, openings, and penetrations. Show details of flexible flashing applications.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Sample Warranties: For Special Warranties.

**1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: A qualified firm that is approved, authorized, certified, or licensed by the weather barrier system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

## **1.6 FIELD CONDITIONS**

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

## **1.7 WARRANTY**

- A. Fluid-Applied Membrane for Rainscreen Installations: Manufacturer agrees to pay the cost of materials and labor to repair or replace Fluid-Applied Membranes that do not comply with requirements or that fail due solely to failure of the products within the specified warranty period.
  - 1. Warranty Period: Five (5) years from date of Substantial Completion.
- B. Building Wrap: Manufacturer agrees to pay the cost of materials and labor to repair or replace Building Wraps that do not comply with requirements or that fail due solely to failure of the products within the specified warranty period.
  - 1. Warranty Period: Ten (10) years from date of Substantial Completion.
- C. Flexible Flashing: Manufacturer agrees to pay the cost of materials and labor to repair or replace Flexible Flashings that do not comply with requirements or that fail due solely to failure of the products within the specified warranty period.
  - 1. Warranty Period: Ten (10) years from date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.1 WEATHER BARRIERS**

- A. General: Fluid Applied Membrane, Building Wrap, Flexible Flashing and Sealant and Liquid Flashing shall be products of the same manufacturer.
  - 1. Basis of Design Manufacturer: Subject to compliance with requirements, provide products manufactured by GCP Applied Technologies, or if approved by Architect, products manufactured by one of the following:
    - a. Henry Company
    - b. Sto Corporation
    - c. Dupont
    - d. or equal
- B. Building Wrap: Fully-adhered weather resistive barrier sheet, consisting of a breathable carrier film coated with an adhesive.
  - 1. Basis of Design Product: Subject to compliance with requirements, provide Vycor enV-S.
    - a. Air Permeance: Less than 0.0004 cfm/sq. ft per ASTM E2178.
    - b. Water Resistance: Pass AATCC-127 Hydrostaic Head per ICC-ES AC-38.
    - c. Water Penetration Resistance around nails: Pass per ASTM D1970.
    - d. Surface Burning Characteristics: Class A - Flame spread index of 5, smoke developed index of 15 per ASTM E84.
    - e. Maximum UV exposure: 180 days.

- f. Color: White.
- C. Building Wrap as Second Layer at Cement Plaster Applications Only: Building Paper backed metal lath as specified in Section 09 24 00 "Cement Plastering" is additional layer.
- D. Flexible Flashing: Self-Adhering, High-Density, Cross-Laminated, Polyethylene sheet with a pressure-sensitive rubberized asphalt adhesive.
  - 1. Basis of Design Product: Vycor Plus.
    - a. Thickness: 25 mil.
    - b. In-service Temperature: -40 degrees F to +160 degrees F.
    - c. UV exposure limit: 30 days.
    - d. Color: Black-Grey.
    - e. Non Compatible with flexible PVC or high concentrations of resin (pitch).
- E. Sealant and Liquid Flashing: As recommended in writing by Building Wrap manufacturer.

## **2.2 ACCESSORY MATERIALS**

- A. Requirement: Provide primers, fasteners, seam tapes, flashing, transition strips, termination strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by weather barrier manufacturer to produce a complete weather barrier assembly and that are compatible with primary weather barrier material and adjacent construction to which they may seal.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION OF WEATHER BARRIERS**

- A. Weather Barriers:
  - 1. Comply with manufacturer's written instructions and warranty requirements.
- B. Install weather barrier accessories for a complete installation with weather barriers in accordance with manufacturers written instructions.
- C. Repairing Building Wrap: Comply with Building Wrap manufacturer to repair tears and holes. Slit and flatten fish-mouths and blisters. Patch with self-adhered membrane extending 3 inches beyond repaired areas and seal edges with manufacturer's sealant.
- D. Install weather barriers over approved exterior sheathing.

## **END OF SECTION**

**SECTION 07 41 13**  
**METAL ROOF PANELS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Manufactured metal roof panel system.

**1.2 ACTION SUBMITTALS**

- A. Product Data:
  - 1. Roofing system components and finishes.
  - 2. Underlayment.
  - 3. Initial selection color charts and Samples.
- B. Shop Drawings: Show material profile, seam spacing and details, fastening methods, flashings, terminations, and installation details.
  - 1. Provisions for thermal expansion and contraction.
  - 2. Fascia trim.
  - 3. Hanging gutters and downspouts.
  - 4. Built in gutters and their connections to drain piping.
  - 5. Snow guards.
- C. Samples: Metal and finish, 8 by 10 inches, minimum.

**1.3 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For metal finish.
- B. Manufacturer warranty documentation.

**1.4 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Installers: Specializing in sheet metal roof fabrication and installation, approved or trained by manufacturer.

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

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage. Provide waterproof coverings to prevent uneven weathering.
- B. Prevent contact with discoloring or staining materials.

## **1.6 PROJECT CONDITIONS**

- A. Do not install underlayment at ambient or surface temperatures less than 40 degrees F.
- B. Do not install panels on wet or frozen substrates.

## **1.7 WARRANTY**

- A. Roofing System: Warrant system against damage under design wind conditions and water leakage through roof system.
  - 1. Make repairs to roofing system required due to defects in materials or workmanship resulting in water leakage into or through roofing system.
  - 2. Include labor and materials necessary to make required repairs.
  - 3. Not limited to specific dollar amount.
  - 4. Warranty Period: 20 years.
- B. Finish Warranty: Repair deteriorated finishes or replace components.
  - 1. Deterioration includes the following:
    - a. Color Fading: More than 5 Hunter units per ASTM D2244.
    - b. Chalking: More than No. 8 rating per ASTM D4214.
    - c. Paint cracking, peeling or checking.
  - 2. Warranty Period - film integrity: 45 years.
  - 3. Warranty Period - chalk and fade rating: 35 years.
  - 4. Warranty Period - perforation: 25 years.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURED METAL ROOF PANEL SYSTEM**

- A. Metal Roofing: Architectural standing seam panel roofing system with snap-on seam covers.
  - 1. Manufacturers :
    - a. Metal Sales
    - b. ATAS International, Inc. PC System.
    - c. Berridge Manufacturing Co.
    - d. Centria Architectural Systems.
    - e. Fabral.
    - f. Petersen Aluminum Corporation PAC-CLAD.
    - g. Taylor Metal Products.



- h. Or approved equal.
- 2. Product: Metal Sales, Vertical Seam Series (basis of design)
- 3. Substitutions: Not permitted.
- 4. Seam Height: Nominal inch.
- 5. Seam Spacing: Nominal 16 inches.
- 6. Steel Panel Sytem: 24 gauge standard.
- 7. Panel Surface: Smooth.
- 8. Finish: PVDF coating system.
  - a. Color: Slate Gray.
- B. Panel Clips: Hot-dip galvanized steel designed to fit between two adjacent panels and secure both panels.
- C. Panel Fasteners: Type 304 stainless steel.
- D. Panel End Closures: Sponge neoprene, cut to fit panel configuration, 1 inch depth, minimum.
- E. Sealant: Manufacturer recommended type.

## **2.2 MATERIALS**

- A. Coil Coated Steel Sheet: ASTM A 792, AZ50; structural steel sheet, aluminum zinc alloy coating.

## **2.3 PERFORMANCE**

- A. Structural Design Criteria: See Structural Drawings.
- B. Structural Loads: See Drawings.
- C. Resist loads from design wind speed stated on Structural Drawings without damage, including uplift.
- D. Wind Uplift Rating: UL 508 class UL-90.
- E. Environmental Performance:
  - 1. Water Leakage: ASTM E1646

## **2.4 INSTALLATION ACCESSORIES**

- A. Waterproof Underlayment: High temperature resistant, self-adhesive modified bitumen sheets recommended by manufacturer for use under metal roofing.
  - 1. Manufacturers and Products:
    - a. Carlisle WIP 300HT.
    - b. GCP Applied Technologies Grace Ice and Water Shield HT.
    - c. Henry Company Blueskin PE200 HT.

## **2.5 FABRICATION**

- A. Fabrication Standard: SMACNA Architectural Sheet Metal Manual.
- B. Form pieces in longest practical lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- E. Fabricate flashing and termination and fascia trim from same material as roof panels.
- F. Provide escutcheons for pipe and conduit penetrations.

## **2.6 STEEL FINISHES**

- A. Liquid Fluoropolymer Steel Sheet Coil Coatings: Two coat system, 70 percent PVDF resin by weight, minimum.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves, or projections, and properly sloped for drainage.
- B. Verify deck is dry .
- C. Verify joints in wood deck are solidly supported and fastened.
- D. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set.
- E. Verify roofing termination and base flashings are in place, sealed, and secure.

### **3.2 PREPARATION**

- A. Fill knot holes and surface cracks with latex filler or cover with aluminum sheet to provide continuous support for underlayment.
- B. Broom clean deck surfaces.

### **3.3 INSTALLATION OF SELF-ADHESIVE UNDERLAYMENT**

- A. Apply primer if recommended by manufacturer.
- B. Starting at low edge, apply one ply of underlayment horizontally over substrate and

parallel to roof edge.

- C. Weather lap each strip 4 inches minimum over previous strip.
- D. Lap ends 6 inches minimum.
- E. Press laps with roller for flat, full contact seams.
- F. Apply second layer of full-width material centered on valleys and ridges.
- G. Press to full bond with substrate without voids, wrinkles, bridging, or fishmouths. Seal ends and edges.
- H. Extend minimum 6 inches up adjacent vertical surfaces.

### **3.4 INSTALLATION OF METAL PANELS**

- A. Install panels aligned and plumb.
- B. Fasten panels to support with concealed fasteners.
- C. Where panels cannot be installed in single lengths, align horizontal lap seams with alternating lengths between adjacent panels.
- D. Install trim to maintain visual continuity of system in flat surfaces free of buckling or oilcanning.
- E. Apply trim and flashing with screws for secure, weatherproof performance.
  - 1. Where fasteners have to be exposed on trim or flashings, use fasteners with heads finished to match panels and with neoprene washers.
- F. Install joint sealers and gaskets to prevent water penetration.
- G. Flash penetrations through roofing with metal trim to match panels:
  - 1. Lap flashings over roof panels 8 inches minimum on all sides and seal with double bead of sealant.
  - 2. Install metal draw band and sealant at top of pipe penetrations.
  - 3. Install water diverters at uphill side of square and rectangular penetrations.
- H. Installation Tolerances:
  - 1. Variation from Location: Plus or minus 1/4 inch.
  - 2. Variation from Plane: 1/4 inch in 10 feet.
  - 3. Misalignment of Horizontal Lap Seams: 1/4 inch.

### **3.5 PROTECTION**

- A. Do not permit traffic over unprotected roof surface.

## **END OF SECTION**

**SECTION 07 46 46**  
**FIBER-CEMENT SIDING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes.
  - 1. Fiber-cement lock joint siding.
  - 2. Fiber-cement panel siding (board and batten).
  - 3. Fiber-cement soffits.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination Procedures:
  - 1. Coordinate siding installation with air barriers, flashing, and other adjoining Work.

**1.3 ACTION SUBMITTALS**

- A. Product Data:
  - 1. Materials, component profiles, fastening methods, jointing details, sizes, surface texture, [finishes], and accessories.
  - 2. Initial selection color [charts] and [Samples].
- B. Shop Drawings: Detail the following:
  - 1. Fabrication and installation layouts.
  - 2. Edge conditions at openings and corners.
  - 3. Penetrations.
  - 4. Flashing, trim and anchorage.
- C. Samples:
  - 1. Siding and Soffit: .
  - 2. Trim: 12 inch long by actual width.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Certificates:
  - 1. Product Certificates: For type of fiber-cement siding and soffit.
- B. Test and Evaluation Reports: Manufacturer test results for fiber-cement siding.
  - 1. <Performance report>
- C. Qualification Statements: Manufacturer and installer.

## **1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: Product and accessories, include in maintenance manual.
- B. Warranty Documentation: Fiber-cement components.

## **1.6 WARRANTY**

- A. Manufacturer Warranty:
  - 1. Fiber-Cement Siding <Product>: Warrant against product and installation failure.
    - a. Failure includes structural failure and deterioration of materials.
    - b. Warranty Period - materials and workmanship: 30 years.

## **PART 2 PRODUCTS**

### **2.1 FIBER-CEMENT LOCK JOINT SIDING**

- A. Fiber-Cement Lock Joint Siding: ASTM C1186, Grade II minimum, Type A.
  - 1. Manufacturers:
    - a. James Hardie Artisan Siding Smooth as basis of design.
    - b. Nichiha Siding.
    - c. Swisspearl
    - d. Or approved equal.
  - 2. Thickness: 5/8 inch.
  - 3. Plank Height: 10 1/4 inches.
  - 4. Exposed Faces: 9 inches.
  - 5. Texture: Smooth.
  - 6. Finish: Factory primed for field finishing.
    - a. Color: See Drawings.
  - 7. Profile: Square Channel.
- B. Fiber-Cement Trim: Siding manufacturer matching products.
  - 1. Trim Sizes: See Drawings.
  - 2. Texture: Smooth.
  - 3. Finish: Factory primed for field finishing.
    - a. Color: See Drawings.

### **2.2 FIBER-CEMENT PANEL SIDING (BOARD AND BATTEN)**

- A. Fiber-Cement Panels: ASTM C1186, Grade II minimum, Type A.
  - 1. Manufacturers and Products:
    - a. James Hardie HardiePanel Vertical Siding (basis of design) Smooth.
    - b. Nichiha Siding.
    - c. Swisspearl Group.
    - d. Or approved equal.
  - 2. Panel Sizes: See Drawings.
  - 3. Thickness: 5/16 inch.
  - 4. Texture: Smooth.

5. Finish: Factory primed for field finishing.
  - a. Color: See Drawings.
- B. Fiber-Cement Battens and Trim: Siding manufacturer matching products.
  1. Batten Sizes: Manufacturer's standard.
  2. Trim Sizes: See Drawings.
  3. Texture: Smooth.
  4. Finish:
    - a. Color: Factory primed for field finish.

## **2.3 FIBER-CEMENT SOFFITS**

- A. Fiber-Cement Soffit Panels: ASTM C1186, Grade II minimum, Type A.
  1. Manufacturers and Products:
    - a. JamesHardie; HardieSoffit Panels, Vented Smooth.
    - b. Nichiha NichiSoffit.
    - c. Swisspearl Group.
  2. Profile: Smooth.
  3. Thickness: 1/4 inch.
  4. Finish: Factory primed for field finishing.
    - a. Color: See Drawings.
- B. Continuous Soffit Vents: Aluminum, 2-3/4 inches wide by 96 inches long, with integral insect screen.
  1. Net Free Area: 9 square inches per linear foot.

## **2.4 INSTALLATION COMPONENTS**

- A. Furring Strips: Preservative treated lumber.
- B. Starter Bars, Panel Clips, and Corner Clips: Panel manufacturer recommended products.
- C. Fasteners: Type recommended by siding manufacturer; hot dip galvanized steel, heads colored to match fiber-cement finish.
- D. Flashing: See Section 076200.
- E. Sealant: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verification of Conditions:
  1. Verify substrate installation and air barrier application is complete per Section 072700.
  2. Verify framing members are ready to receive fiber-cement siding systems.

3. Verify penetrations are complete and securely fastened.

### **3.2 PREPARATION**

- A. Installation Direct to Sheathing:
  1. Mark stud locations with chalk lines.
  2. Install preservative treated wood furring behind fiber-cement products.

### **3.3 INSTALLATION - SQUARE CHANNEL SIDING**

- A. Direct to Sheathing Installation:
  1. Install 1/4 inch preservative treated wood starter strip at first course. Lap first siding course minimum 1/2 inch over starter strip.
- B. Apply siding boards level with uniform manufacturer recommended lap width.
- C. Face screw boards to framing members.
- D. Align vertical joints over framing members.
- E. Butt running joints in full contact with sealant.
- F. Allow 1/8 inch space between siding boards and trim. Fill joint with sealant.
- G. Stagger butt joints minimum 24 inches between courses.
- H. Paint field-cut edges to match factory finish.
- I. Erection Tolerances:
  1. Offset Between Adjacent Members: 1/16 inch, maximum.
  2. Variation from Plane or Location: 1/4 inch in 20 feet, maximum.

### **3.4 INSTALLATION - BATTENS AND TRIM**

- A. Install trim plumb, level, and accurately aligned.
- B. Apply sealant to joints between siding and trim and between trim pieces.
- C. Face screw trim to face panels.
- D. Corners: Butt joints.
- E. Paint field-cut edges to match factory finish.

### **3.5 CLEANING**

- A. Protect installed products. Touch-up, repair, or replace damaged products before Substantial Completion.

**END OF SECTION**



## **SECTION 07 54 19**

### **POLYVINYL-CHLORIDE (PVC) ROOFING**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Polyvinyl chloride (PVC) roofing system.
  - 2. Roof board.
  - 3. Roof insulation.
  - 4. Walkways.
  - 5. PVC coated metal.
  - 6. Roofing Accessories.
- B. Related Requirements:
  - 1. Section 06 10 00 "Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
  - 2. Section 07 21 00 "Thermal Insulation" for insulation beneath the roof deck.
  - 3. Section 07 62 00 "Sheet Metal Flashing and Trim" for non-PVC coated metal roof flashings and counterflashings.
  - 4. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

##### **1.3 PREINSTALLATION MEETINGS**

- A. Preinstallation Roofing Conference: Conduct conference at Project site.
  - 1. Meet with District Construction Manager, Project Inspector, Architect, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
  - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
  - 3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Examine deck substrate conditions and finishes for compliance with

- requirements, including flatness and fastening.
- 5. Review structural loading limitations of roof deck during and after roofing.
- 6. Review special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
- 7. Review governing regulations.
- 8. Review temporary protection requirements for roofing system during and after installation.
- 9. Review roof observation and repair procedures after roofing installation.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Include roof plans, elevations, sections, details, and attachments to other work, including:
  - 1. Base flashings and membrane terminations.
  - 2. Tapered insulation, thicknesses, and slopes.
  - 3. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
  - 4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
  - 5. Walkways
- C. Samples for Verification: For the following products:
  - 1. Roofing membrane, of color required.
  - 2. PVC coated metal of color required.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer Certificates:
  - 1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
    - a. Submit evidence of compliance with performance requirements.
  - 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
- C. Product Test Reports: For roof membrane and insulation, tests performed by independent qualified testing agency indicating compliance with specified requirements.
- D. Field quality-control reports.
- E. Sample Warranties: For manufacturer's special warranties.

## **1.6 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For roofing system to include in maintenance manuals.
- B. Information Card: Furnish a typewritten card, laminated in plastic. Card shall be 8-1/2-by-11 inches and shall contain the information listed on Form 1 located at end of this section.

## **1.7 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
  - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

## **1.9 FIELD CONDITIONS**

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

## **1.10 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period, without monetary limitation.
  - 1. Special warranty includes roof membrane, base flashings, roof insulation,, fasteners,, substrate board,, and walkways, and other components of roofing system.
  - 2. Warranty Period: 25 years from date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain components including roof insulation and fasteners for roofing system from same manufacturer as roof membrane or manufacturer approved by roof membrane manufacturer.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.
  - 1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. Energy Performance: Roofing system shall have a minimum aged solar reflectance of 0.63 and a minimum thermal emittance of 0.75 or a minimum solar reflectance index (SRI) of 75 when tested according to CRRC-1.
- D. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A, for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- E. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

### **2.3 PVC ROOFING**

- A. PVC Sheet: ASTM D 4434/D 4434M, Type III, fabric reinforced.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Sika Sarnafil (Basis of Design).
  - b. Johns Manville; a Berkshire Hathaway company.
  - c. GAF Materials Corporation.
  - d. Or Equal.
- B. Manufacturer System: Sika Sarnafil 'PVC' 25-Year Roofing System # S 327-72FB.
- C. Main Field Sheet: S 327 PVC 72 mils thermoplastic membrane with felt back.
- D. Flashing Membranes: G 410, G 410 SA and/or Sarnaclad.
- E. Main Field and Flashings: EnergySmart (White), initial reflectivity of 0.83, initial emissivity 0.90, and a solar reflective index (SRI) of >104.
- F. Wall/Curb Flashing
  - 1. Sarnafil G410 Membrane.
  - 2. Sarnafil G 410 SA Flashing Membrane (self-adhered).
  - 3. Sarnaclad PVC-coated sheet metal. 24 gauge, G90 galvanized steel with a PVC-coating on one side for heat-weldability shop fabricated to meet project requirements.
- G. Perimeter Edge Flashing
  - 1. Sarnaclad PVC-coated sheet metal. 24 gauge, G90 galvanized steel with a PVC-coating on one side for heat-weldability shop fabricated to meet project requirements.
- H. Membrane Fasteners
  - 1. Sarnadisc-XP. 18 gauge (1.2 mm), 1-1/2" by 3-3/4" (38 mm x 95 mm) steel plate with a Galvalume coating, used with #14 or #15 XP Sarnafasteners to attach membrane to the roof deck.
- I. Flashing Adhesive
  - 1. Sarnacol 2170 VC Adhesive. Solvent-based, VOC-compliant, reactivating adhesive used to attach roof membrane and flashing.
  - 2. Other Manufacturer-approved adhesives for stated roof warranty as required for a complete roofing system installation.
- J. Sealants
  - 1. Sikaflex-1a. Moisture-cured, one-component polyurethane-based, non-sag elastomeric sealant used in wall, curb and drain terminations. It is also used as a sealant at pipe penetrations and under certain metal flashings. Sikaflex-1a can be used as a pourable sealer pocket filler.
  - 2. Sikasil SG-10. One-component silicone adhesive.

## 2.4 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.

- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, and color as PVC sheet.
- C. Bonding Adhesive: Manufacturer's standard, water based for horizontal applications; solvent based for vertical applications.
- D. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1-by-1/8-inch-thick; with anchors.
- E. Miscellaneous Accessories: All fasteners, anchors, nails, straps, bars, etc. shall be post-galvanized steel, aluminum or stainless steel. Mixed metal type components shall be assembled in such a manner as to avoid galvanic corrosion. Fasteners for attachment of metal to masonry shall be expansion type fasteners with stainless steel pins.

## **2.5 PVC COATED SHEET METAL**

- A. Roof membrane manufacturer's standard .028-inch thick minimum galvanized sheet metal laminated to minimum 20-mil-thick non-reinforced PVC membrane. Color to match roofing membrane.

## **2.6 ROOF BOARDS**

- A. Sarnatherm Roof Board A-III. High density polyisocyanurate 1/2" (12.7 mm) roof board with coated glass facers, meeting ASTM C-1289 Type II, Class 4, Grade 1.

## **2.7 ROOF INSULATION**

- A. General: Preformed roof insulation boards manufactured by PVC roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses to achieve slopes and R-values indicated.
- B. Sarnatherm. Polyisocyanurate Board Insulation ASTM C 1289, Type II, Class 1, Grade 2, with glass fiber reinforced felt facers.
- C. Tapered Insulation: Provide factory-tapered insulation boards.
  - 1. Material: Match roof insulation.
  - 2. Minimum Thickness: 1/4-inch (6.35 mm).
  - 3. Slope:
    - a. Roof Field: 1/4-inch per foot (1:48) unless otherwise indicated on Drawings.
    - b. Saddles and Crickets: 1/2-inch per foot (1:24) unless otherwise indicated on Drawings.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

## **2.8 INSULATION ACCESSORIES**

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.
- B. Attachment Plates/Fasteners: Sarnaplate. 26 gauge, 3" (76 mm) square or round steel plate with a Galvalume coating, used with #12, #14, and #15 Sarnafasteners to attach Sarnatherm insulation, Sarnatherm roof boards, gypsum roof boards, or other Sika approved boards to the roof deck.

## **2.9 WALKWAYS**

- A. Crossgrip XTRA. Rolled-out walkway protection mat loose laid on top of completed roof assemblies consisting of 5/8" (16 mm) thick flexible PVC with cross-directional textured ribs.
  - 1. Color: Match roof membrane.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
  - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
  - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

### **3.3 ROOFING INSTALLATION, GENERAL**

- A. Install roofing system according to roofing system manufacturer's written instructions.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when

rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

### **3.4 ROOF BOARD INSTALLATION**

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.
  - 1. Tightly butt substrate boards together.
  - 2. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
- B. Adhered Substrate Board Installation: Install substrate board and adhere to insulation as follows:
  - 1. Set substrate board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining board in place.
  - 2. Set substrate board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining board in place.

### **3.5 INSULATION INSTALLATION**

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is greater than 3/4-inch, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4-inch with insulation.
  - 1. Cut and fit insulation within 1/4-inch of nailers, projections, and penetrations.
- G. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
  - 1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.



### **3.6 BASE FLASHING INSTALLATION**

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

### **3.7 WALKWAY INSTALLATION**

- A. Flexible Walkways: Install walkway products according to manufacturer's written instructions in locations indicated on Drawings. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

### **3.8 FIELD QUALITY CONTROL**

- A. Constant Observation and Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to provide constant onsite inspections of roofing installation and on completion to prepare inspection report.
- B. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

### **3.9 PROTECTING AND CLEANING**

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and District Construction Manager.

- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

**END OF SECTION**

## **SECTION 07 62 00**

### **SHEET METAL FLASHING AND TRIM**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Manufactured reglets with counterflashing.
  - 2. Formed roof-drainage sheet metal fabrications.
  - 3. Formed low-slope roof sheet metal fabrications.
  - 4. Formed steep-slope roof sheet metal fabrications.
  - 5. Formed wall sheet metal fabrications.
  - 6. Formed equipment support flashing.
  - 7. Formed overhead-piping safety pans.
- B. Related Requirements:
  - 1. Section 06 10 00 "Rough Carpentry" for wood nailers, curbs, and blocking.
  - 2. Section 07 41 13 "Metal Roof Panels" for materials and installation of sheet metal flashing and trim integral with roofing.
  - 3. Section 07 72 00 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

##### **1.3 COORDINATION**

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leak proof, secure, and noncorrosive installation.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and

accessory.

- B. Shop Drawings: For sheet metal flashing and trim.
  - 1. Include plans, elevations, sections, and attachment details, including attachments to other work.
  - 2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
  - 3. Include identification of material, thickness, weight, and finish for each item and location in Project.
  - 4. Include details for forming, including profiles, shapes, seams, and dimensions.
  - 5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
  - 6. Include details of termination points and assemblies.
  - 7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
  - 8. Include details of roof-penetration flashing.
  - 9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counter flashings as applicable.
  - 10. Include details of special conditions.
  - 11. Include details of connections to adjoining work.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For fabricator.
- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

## **1.6 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

## **1.7 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal

flashing and trim installation.

## **PART 2 PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings capable of resisting the following design pressure:
  - 1. Design Pressure: As indicated on Drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

### **2.2 SHEET METALS**

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation; .
  - 1. Surface: Smooth, flat.
  - 2. Exposed Coil-Coated Finish:
    - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 3. Color: As selected by Architect from manufacturer's full range.

### **2.3 UNDERLAYMENT MATERIALS**

- A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

- B. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Carlisle Coatings & Waterproofing Inc.
    - b. Henry Company.
    - c. Owens Corning.
    - d. Or Equal.
  - 2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
  - 3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F. or lower.
- C. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

## **2.4 MISCELLANEOUS MATERIALS**

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
  - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
    - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
    - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
  - 2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Solder:
  - 1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, with maximum lead content of 0.2 percent.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2-inch wide and 1/8-inch thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

- F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## **2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM**

- A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Fry Reglet Corporation.
    - b. Hickman Company, W. P.
    - c. IMETCO
    - d. Or equal.
  - 2. Material: Galvanized steel, 0.028 inch thick.
  - 3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
  - 4. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
  - 5. Accessories:
    - a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
    - b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
  - 6. Finish: Mill.

## **2.6 FABRICATION, GENERAL**

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
  - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
  - 2. Obtain field measurements for accurate fit before shop fabrication.
  - 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
  - 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4-inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
  - 1. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- H. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

## **2.7 ROOF-DRAINAGE SHEET METAL FABRICATIONS**

- A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch-long sections. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
  - 1. Gutter Profile: As indicated on Drawings.
  - 2. Expansion Joints: Butt type with cover plate.
  - 3. Accessories: Wire-ball downspout strainer.
  - 4. Gutters with Girth up to 25 Inches: Fabricate from the following materials:
    - a. Galvanized Steel: 0.034-inch minimum thick.
  - 5. Gutters with Girth 26 to 30 Inches: Fabricate from the following materials:
    - a. Galvanized Steel: 0.040-inch thick.
  - 6. Gutters with Girth 31 to 35 Inches: Fabricate from the following materials: thick:
  - 7. Gutters with Girth 31 to 35 inches: Fabricate from the following materials:
    - a. Galvanized Steel: 0.052-inch thick.



- B. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers. Shop fabricate elbows.
  - 1. Hanger Style: As indicated on Drawings.
  - 2. Fabricate from the following materials:
    - a. Galvanized Steel: 0.028-inch thick.
- C. Parapet Scuppers: Fabricate scuppers to dimensions indicated on Drawings, with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:
  - 1. Galvanized Steel: 0.028-inch thick.

## **2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS**

- A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long sections. Furnish with 6-inch-wide, joint cover plates.
  - 1. Joint Style: Overlapped, 4 inches wide.
  - 2. Fabricate from the Following Materials:
    - a. Galvanized Steel: 22 gage / 0.03125-inch minimum and 20 gauge/0.0375 thick.
- B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, [fasten and seal] watertight.
  - 1. Coping Profile: As indicated on Drawings.
  - 2. Joint Style: Butted with expansion space and 6-inch-wide, exposed cover plate.
  - 3. Fabricate from the Following Materials:
    - a. Galvanized Steel: 20 gage / 0.0375-inch minimum thick.
- C. Roof-to-Wall Transition, Roof-to-Roof Edge-Flashing (Gravel-Stop) Transition, and Roof-to-Roof Edge-Flashing (Gravel-Stop) and Fascia-Cap Transition Expansion-Joint Cover: Fabricate from the following materials:
  - 1. Galvanized Steel: 20 gage / 0.0375-inch minimum thick.
- D. Counterflashing: Fabricate from the following materials:
  - 1. Galvanized Steel: 22 gage / 0.03125-inch minimum thick.
- E. Flashing Receivers: Fabricate from the following materials:
  - 1. Galvanized Steel: 22 gage / 0.03125-inch minimum thick.
- F. Roof-Penetration Flashing: Fabricate from the following materials:
  - 1. Galvanized Steel: 20 gage / 0.0375-inch minimum thick.
- G. Roof-Drain Flashing: Liquid-applied elastomeric membrane flashing system compatible with roofing system.

## **2.9 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS**

- A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:
  - 1. Galvanized Steel: 20 gage / 0.0375-inch minimum thick.
- B. Valley Flashing: Fabricate from the following materials:
  - 1. Galvanized Steel: thick.
- C. Drip Edges: Fabricate from the following materials:
  - 1. Galvanized Steel: 20 gage / 0.0375-inch minimum thick.
- D. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials:
  - 1. Galvanized Steel: 20 gage / 0.0375-inch minimum thick.
- E. Counterflashing: Fabricate from the following materials:
  - 1. Galvanized Steel: 20 gage / 0.0375-inch minimum thick.
- F. Flashing Receivers: Fabricate from the following materials:
  - 1. Galvanized Steel: 20 gage / 0.0375-inch minimum thick.
- G. Roof-Penetration Flashing: Fabricate from the following materials:
  - 1. Galvanized Steel: 20 gage / 0.0375-inch minimum thick.

## **2.10 WALL SHEET METAL FABRICATIONS**

- A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:
  - 1. Galvanized Steel: 20 gage / 0.0375-inch minimum thick.
- B. Wall Expansion-Joint Cover: Fabricate from the following materials:
  - 1. Galvanized Steel: 20 gage / 0.0375-inch minimum thick.

## **2.11 MISCELLANEOUS SHEET METAL FABRICATIONS**

- A. Equipment Support Flashing: Fabricate from the following materials:
  - 1. Galvanized Steel: 20 gage / 0.0375-inch minimum thick.
- B. Overhead-Piping Safety Pans: Fabricate from the following materials:
  - 1. Galvanized Steel: 20 gage / 0.0375-inch minimum thick.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
  - 1. Verify compliance with requirements for installation tolerances of substrates.
  - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 UNDERLAYMENT INSTALLATION**

- A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.
- B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.
- C. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

### **3.3 INSTALLATION, GENERAL**

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
  - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
  - 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
  - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
  - 5. Torch cutting of sheet metal flashing and trim is not permitted.

- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
  - 1. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
  - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
  - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
  - 1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1-inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
  - 2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

### **3.4 ROOF-DRAINAGE SYSTEM INSTALLATION**

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Hanging Gutters: Join sections with joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.
  - 1. Fasten gutter spacers to front and back of gutter.
  - 2. Anchor and loosely lock back edge of gutter to continuous eave or apron flashing.
  - 3. Anchor gutter with straps spaced not more than 36 inches apart to roof deck, unless otherwise indicated, and loosely lock to front gutter bead.
  - 4. Install gutter with expansion joints at locations indicated, but not exceeding, 50

feet apart. Install expansion-joint caps.

- C. Downspouts: Join sections with 1-1/2-inch telescoping joints.
  - 1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c.
  - 2. Provide elbows at base of downspout to direct water away from building.
- D. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in elastomeric sealant compatible with the substrate.
- E. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
  - 1. Anchor scupper closure trim flange to exterior wall and seal with elastomeric sealant to scupper.
- F. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints minimum of 4 inches in direction of water flow.
- G. Roof Drains: Install per drain and flashing manufacturers' instructions.

### **3.5 ROOF FLASHING INSTALLATION**

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
  - 1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
  - 2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of snap-in installation

and sealant unless otherwise indicated.

- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

### **3.6 WALL FLASHING INSTALLATION**

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Reglets: Installation of reglets is specified in Section 04 22 00 "Concrete Unit Masonry."
- C. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

### **3.7 MISCELLANEOUS FLASHING INSTALLATION**

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.
- B. Overhead-Piping Safety Pans: Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

### **3.8 ERECTION TOLERANCES**

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

### **3.9 CLEANING AND PROTECTION**

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.

- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION**

## **SECTION 07 72 00**

### **ROOF ACCESSORIES**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Equipment supports.
  - 2. Roof hatches.
  - 3. Pipe and duct supports.
  - 4. Pipe portals.
  - 5. Preformed flashing sleeves.
  - 6. Bird Deterrents.
  - 7. Safety Railing System.
- B. Related Sections:
  - 1. Section 05 50 00 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
  - 2. Section 07 62 00 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

##### **1.3 COORDINATION**

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of roof accessory.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.



- B. Shop Drawings: For roof accessories.
  - 1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

## **1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

## **1.6 QUALITY ASSURANCE**

- A. Standards: Comply with the following:
  - 1. SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

## **PART 2 PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

### **2.2 EQUIPMENT SUPPORTS**

- A. Equipment Supports: Rail-type metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed structure-mounting flange at bottom.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AES Industries, Inc.
    - b. Air Balance Inc.; a division of MESTEK, Inc.
    - c. Greenheck Fan Corporation.
    - d. Or Equal.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Supported Load Capacity: As indicated on Drawings.
- D. Material: Aluminum-zinc alloy-coated steel sheet, 0.052-inch thick.
  - 1. Finish: Mill phosphatized.

## 2.3 ROOF HATCH

- A. Roof Hatches: Metal roof-hatch units with lids and insulated single-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Babcock-Davis.
    - b. Bilco Company (The).
    - c. Dur-Red Products.
    - d. Or Equal.
- B. Type and Size: Single-leaf lid, 48-by-48 inches.
- C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.
- D. Hatch Material: Zinc-coated (galvanized) steel sheet.
  - 1. Thickness: Manufacturer's standard thickness for hatch size indicated.
- E. Finish: Mill phosphatized. Hatch Material: Aluminum sheet.
  - 1. Thickness: Manufacturer's standard thickness for hatch size indicated.
  - 2. Finish: Mill.
- F. Construction:
  - 1. Insulation: Polyisocyanurate board.
    - a. R-Value: 6.0 according to ASTM C 1363.
  - 2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
  - 3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
  - 4. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
  - 5. Fabricate curbs to minimum height of roof insulation thickness + minimum base flashing height recommended by roofing membrane manufacturer.
  - 6. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.
- G. Hardware: Spring operators, hold-open arm, galvanized-steel spring latch with turn handles, galvanized -steel butt- or pintle-type hinge system, and padlock hasps inside and outside.
  - 1. Provide two-point latch on lids larger than 84 inches.
- H. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements.
  - 1. Height: 42 inches above finished roof deck.

2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
  3. Flat Bar: Galvanized steel, 2 inches high by 3/8-inch thick.
  4. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
  5. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
  6. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
  7. Fabricate joints exposed to weather to be watertight.
  8. Fasteners: Manufacturer's standard, finished to match railing system.
  9. Finish: Manufacturer's standard.
    - a. Color: As selected by Architect from manufacturer's full range.
- I. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
  2. Height: 42 inches above finished roof deck.
  3. Material: Steel tube.
  4. Post: 1-5/8-inch-diameter pipe.
  5. Finish: Manufacturer's standard baked enamel or powder coat.
    - a. Color: As selected by Architect from manufacturer's full range.

## 2.4 PIPE AND DUCT SUPPORTS

- A. Fixed-Height Cradle-Type Pipe Supports: Polycarbonate pipe stand accommodating up to 1-1/2-inch- diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.
- B. Fixed-Height Roller-Bearing Pipe Supports: Polycarbonate pipe stand with polycarbonate roller carrying assembly accommodating up to 7-inch- diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.
- C. Duct Supports: Extruded-aluminum, urethane-insulated supports, 2 inches in diameter; with manufacturer's recommended hardware for mounting to structure or structural roof deck.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eberl Iron Works, Inc.
    - b. PHP Systems Design.
    - c. Thaler Metal Industries Ltd.
    - d. Or Equal.
  2. Finish: Manufacturer's standard.

## **2.5 PIPE PORTALS**

- A. Curb-Mounted Pipe Portal: Insulated roof-curb units with welded or mechanically fastened and sealed corner joints, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom; with weathertight curb cover with single or multiple collared openings and pressure-sealed conically shaped EPDM protective rubber caps sized for piping indicated, with stainless-steel snaplock swivel clamps.
- B. Flashing Pipe Portal: Formed aluminum membrane-mounting flashing flange and sleeve with collared opening and pressure-sealed conically shaped EPDM protective rubber cap sized for piping indicated, with stainless-steel snaplock swivel clamps.

## **2.6 PREFORMED FLASHING SLEEVES**

- A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted metal collar.
  - 1. Metal: Aluminum sheet, 0.063-inch thick.
  - 2. Diameter: As indicated on Drawings.
  - 3. Finish: Manufacturer's standard.

## **2.7 BIRD DETERRENTS**

- A. General: 3/4" U.V. stabilized knotted polyethylene net. Flame resistant (270°F melting point). Rot-proof, non-conductive and stable in subzero temperatures.
  - 1. Color: Black.
  - 2. Warranty: 10-year warranty against material defects and workmanship.
    - a. Installation shall be performed by an Authorized Installer.
- B. Manufacturers and Product: Subject to compliance with requirements, provide products by one of the following:
  - 1. Bird-B-Gone, Inc.; Bird Net 2000 (Basis-of-Design).
  - 2. Bird-X.
  - 3. ProPacific Bird Control.
  - 4. Or Equal.

## **2.8 SAFETY RAILING SYSTEM**

- A. Ballasted Guard Railing System:
  - 1. Cal-OSHA 3209 compliant, free-standing, non-penetrating, counterweighted, 42 inch high guardrail system to prevent falls from open sides of roof including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation.
- B. Manufacturers and Products: Subject to compliance with requirements, provide products by one of the following:
  - 1. Diversified Fall Protection, Counterweighted Guard Railing System.
  - 2. Garlock Safety Systems, Fit-Rite Safety Rail System.
  - 3. Safety Rail Co., Accu-Fit Mobile Rail.

4. Or Equal.

## **2.9 METAL MATERIALS**

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90coating designation and mill phosphatized for field painting where indicated.
  - 1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2-mil.
- B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50coated.
  - 1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2-mil.
- C. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
  - 1. Mill Finish: As manufactured.
- D. Aluminum Extrusions and Tubes: ASTM B 221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.
- E. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.
- F. Steel Tube: ASTM A 500/A 500M, round tube.
- G. Galvanized-Steel Tube: ASTM A 500/A 500M, round tube, hot-dip galvanized according to ASTM A 123/A 123M.
- H. Steel Pipe: ASTM A 53/A 53M, galvanized.

## **2.10 MISCELLANEOUS MATERIALS**

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Glass-Fiber Board Insulation: ASTM C 726, nominal density of 3 lb/cu. ft., thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F, thickness as indicated.
- C. Polyisocyanurate Board Insulation: ASTM C 1289, thickness and thermal resistivity as indicated.
- D. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

- E. Bituminous Coating: SSPC-12, cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M. Free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coating.
- F. Underlayment:
  - 1. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
  - 2. Polyethylene Sheet: 6-mil-thick polyethylene sheet complying with ASTM D 4397.
  - 3. Slip Sheet: Building paper, 3 lb/100 sq. ft minimum, rosin sized.
  - 4. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
  - 5. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
  - 6. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
  - 7. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- H. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- I. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- J. Asphalt Roofing Cement: ASTM D 4586/D 4586M, asbestos free, of consistency required for application.

## **2.11 GENERAL FINISH REQUIREMENTS**

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. General: Install roof accessories according to manufacturer's written instructions.
  - 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
  - 2. Coordinate installation of roof accessories with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other construction involving roof accessories to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.
  - 3. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
  - 4. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
  - 5. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
  - 1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
  - 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
  - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.
- D. Roof-Hatch Installation:
  - 1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
  - 2. Attach safety railing system to roof-hatch curb.

3. Attach ladder-assist post according to manufacturer's written instructions.
- E. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.
  1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
- F. Preformed Flashing-Sleeve and Flashing Pipe Portal Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.
- G. Operational Units: Test-operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.
- H. Cap Flashing: Where required as component of accessory, install cap flashing to provide waterproof overlap with roof flashing (as counterflashing). Seal overlap with thick bead of mastic sealant.
- I. Bird Deterrent Mesh Mounting Systems:
  1. Follow manufacturer's recommended mounting instructions.
  2. Confirm with Structural Engineer is penetrating the steel is acceptable prior to installation.
    - a. If penetrating is not acceptable, girder clips or 2" steel clamps shall be used.
      - 1) Consult with manufacturer on installation requirements.
  3. Steel I-Beams: For corner attachments, use eye bolts with lock nuts. For intermediate attachments, use the appropriate size manufacturer's girder clips.
  4. Other Steel Shapes: For corner attachments use manufacturer's eye bolts with lock nuts. For intermediate attachments, use manufacturer's multi-purpose cable brackets with powder actuated fire-in-pins.
- J. Safety Railing System:
  1. Comply with manufacturer's written installation instructions and recommendations, referenced standards, requirements of authorities having jurisdiction, and approved submittals.
  2. Securely and rigidly install products in place to obtain the required working loads without exceeding allowable loads for each item of fall protection equipment.
- K. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

### **3.3 REPAIR AND CLEANING**

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.



- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 09 91 13 "Exterior Painting."
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

**END OF SECTION**

## **SECTION 07 92 00**

### **JOINT SEALANTS**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Nonstaining silicone joint sealants.
  - 2. Urethane joint sealants.
  - 3. Mildew-resistant joint sealants.
- B. Related Requirements:
  - 1. Section 07 84 13 "Penetration Firestopping".
  - 2. Section 07 84 43 "Joint Firestopping".
  - 3. Section 08 80 00 "Glazing".
  - 4. Section 08 88 13 "Fire Rated Glazing".
  - 5. Section 09 30 13 "Ceramic Tiling".
  - 6. Section 09 51 13 "Acoustical Panel Ceilings".

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
  - 4. Joint-sealant color.

#### **1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

#### **1.5 PRECONSTRUCTION TESTING**

- A. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, and curing time.
- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

#### **1.7 FIELD CONDITIONS**

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

#### **1.8 WARRANTY**

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Manufacturer's standard.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
  - 1. Movement of the structure caused by stresses on the sealant exceeding sealant

- manufacturer's written specifications for sealant elongation and compression.
- 2. Disintegration of joint substrates from causes exceeding design specifications.
- 3. Mechanical damage caused by individuals, tools, or other outside agents.
- 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## **PART 2 PRODUCTS**

### **2.1 JOINT SEALANTS, GENERAL**

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.
- C. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- D. Sealants shall comply with the testing and product requirements of San Diego Air Pollution Control District Rule 67.0 "Architectural Coatings" and Rule 67.21 "Adhesive Material Application Operations".
- E. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food; provide products that comply with 21 CFR 177.2600.

### **2.2 NONSTAINING SILICONE JOINT SEALANTS**

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dow Corning Corporation.
    - b. Pecora Corporation.
    - c. Tremco Incorporated.
    - d. Or Equal.

## **2.3 URETHANE JOINT SEALANTS**

- A. Urethane, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Uses T and NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BASF / Sonneborn Corporation.
    - b. Sika Corporation.
    - c. Tremco Incorporated.
    - d. Or Equal.

## **2.4 MILDEW-RESISTANT JOINT SEALANTS**

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dow Corning Corporation.
    - b. Pecora Corp.
    - c. Tremco Incorporated.
    - d. Or Equal.

## **2.5 JOINT-SEALANT BACKING**

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

## **2.6 MISCELLANEOUS MATERIALS**

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Concrete.
    - b. Masonry.
    - c. Unglazed surfaces of ceramic tile.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    - a. Metal.
    - b. Glass.
    - c. Porcelain enamel.
    - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written

instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### **3.3 INSTALLATION OF JOINT SEALANTS**

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

### **3.4 CLEANING**

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint

sealants and of products in which joints occur.

### **3.5 PROTECTION**

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

### **3.6 JOINT-SEALANT SCHEDULE**

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces .
  - 1. Joint Locations:
    - a. Construction joints in cast-in-place concrete.
    - b. Joints between plant-precast architectural concrete units.
    - c. Control and expansion joints in unit masonry.
    - d. Joints in dimension stone cladding.
    - e. Joints in glass unit masonry assemblies.
    - f. Joints in exterior insulation and finish systems.
    - g. Joints between metal panels.
    - h. Joints between different materials listed above.
    - i. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
    - j. Control and expansion joints in ceilings and other overhead surfaces.
    - k. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Silicone, nonstaining, Type S, Grade NS, Class 50, Use NT.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Interior joints in horizontal traffic surfaces .
  - 1. Joint Locations:
    - a. Isolation joints in cast-in-place concrete slabs.
    - b. Control and expansion joints in tile flooring.
    - c. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Urethane, Type S, Grade NS, Class 25, Use T, NT.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces .
  - 1. Joint Locations:
    - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - b. Tile control and expansion joints where indicated.
    - c. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Silicone, mildew resistant, acid curing, Type S, Grade NS, Class 25, Use NT.



3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces .
  1. Joint Locations:
    - a. Control and expansion joints on exposed interior surfaces of exterior walls.
    - b. Tile control and expansion joints.
    - c. Vertical joints on exposed surfaces of unit masonry, concrete, and partitions.
    - d. Joints on underside of plant-precast structural concrete beams and planks.
    - e. Other joints as indicated on Drawings.
  2. Joint Sealant: Urethane, Type S, Grade NS, Class 25, Use NT.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

**END OF SECTION**

## **SECTION 08 11 13**

### **HOLLOW METAL DOORS AND FRAMES**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section includes:
  - 1. Interior standard steel doors and frames.
  - 2. Exterior standard steel doors and frames.
  - 3. Borrowed lites.
- B. Related Requirements:
  - 1. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.
  - 2. Section 08 80 00 "Glazing" for glazing installed in doors.
  - 3. Section 09 91 13 "Exterior Painting" for field painting of exterior doors and frames.
  - 4. Section 09 91 23 "Interior Painting" for field painting of interior doors and frames.

##### **1.3 DEFINITIONS**

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

##### **1.4 COORDINATION**

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

## **1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
  - 1. Elevations of each door type.
  - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
  - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  - 4. Locations of reinforcement and preparations for hardware.
  - 5. Details of each different wall opening condition.
  - 6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
  - 7. Details of anchorages, joints, field splices, and connections.
  - 8. Details of accessories.
  - 9. Details of moldings, removable stops, and glazing.
- C. Product Schedule: For hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

## **1.6 INFORMATIONAL SUBMITTALS**

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- B. Certification of Label Construction: For labeled doors, certificate from nationally recognized testing agency stating that component construction conforms to UL rating requirements for the label indicated.
- C. Certification of Rated Assembly: For rated assemblies, provide certificate from nationally recognized testing agency that doors provided have been tested for use in assemblies complying with NFPA 80 for fire-protection ratings indicated, based on testing at positive pressure according to UL 10C.
- D. Certification of Physical Endurance: For hollow metal doors, certificate from nationally recognized testing agency that doors comply with requirements of SDI 131-10.
- E. Qualification Data: For Manufacturer, Supplier, and Installer.

## **1.7 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A member of SDI that supplies doors and frames through a national distribution system. Manufacturers that market materials by a factory direct method are not acceptable.

- B. **Supplier Qualifications:** Supplier shall be a qualified direct distributor of the manufacturer's products. The Supplier shall have in its regular employment a person who is currently certified by DHI as an Architectural Hardware Consultant (AHC) or a Certified Door Consultant (CDC). The Supplier shall be available at reasonable times throughout the Project for consultation with Contractor, Architect, and District Construction Manager. The Supplier shall be available for in-person on-site consultation within 48 hours of first notice.
- C. **Installer Qualifications:** Firm with a minimum of five years' experience in the installation of hollow metal doors and frames similar to the type required for this Project.
- D. **Source Limitations:** Obtain hollow-metal work from single source from single manufacturer.
- E. The District Construction Manager may select not more than two doors at random for dismantling and inspection of internal construction for compliance with Project Specifications. Provide doors, labor, and tools for inspection under the District Construction Manager's supervision, at Contractor's expense.
- F. Failure of any hollow metal frame or door to comply with specified requirements shall be grounds to reject the entire shipment of hollow metal doors and frames, as well as to reject the Manufacturer. Items shall be replaced at Contractor's expense, including two additional doors for dismantling and inspection. No extensions of time or additions to the Contract amount will be allowed due to a rejection of material and substitution of the hollow metal Manufacturer.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use unvented plastic.
- B. Upon delivery to the site, inspect hollow-metal work for damage. Minor damage may be repaired provided refinished items are equal to new work and accepted by the District Construction Manager. Otherwise, remove and replace damaged items.
- C. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- D. Store hollow-metal work vertically under cover in a dry, secure location at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation. If cardboard containers become wet, remove containers and dry contents immediately.

## **1.9 WARRANTY**

- A. Special Warranty: Manufacturer agrees to warrant products against defects in materials and workmanship.
  - 1. Warranty Period: One year from date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ceco Door; ASSA ABLOY.
  - 2. Curries Company; ASSA ABLOY.
  - 3. Steelcraft; an Allegion brand.
  - 4. Or Equal.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
  - 1. Smoke- and Draft-Control Assemblies: Provide assemblies with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

### **2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES**

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
  - 1. Physical Performance: SDI A250.4, Level A.
  - 2. Doors:
    - a. Type: As indicated in the Door and Frame Schedule.
    - b. Thickness: 1-3/4 inches.
    - c. Face: Metallic-coated, cold-rolled steel sheet, minimum thickness of 0.053-inch, with minimum A60 coating.
    - d. Edge Construction: Model 2, Seamless construction by continuous wire weld.
    - e. Core: Polystyrene.

- f. Fire-Rated Core: Manufacturer's standard.
- 3. Frames:
  - a. Materials: Metallic-coated, steel sheet, minimum thickness of 0.053-inch, with minimum A60 coating.
  - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
  - c. Construction: Full profile welded.
- 4. Grouting:
  - a. Grout all frames 2'-0" above finished floor with approved non-shrink material and include rebar dowel. Solid grout frames in masonry walls full height.
- 5. Exposed Finish: Factory prime and paint
  - a. Color: Coordinate with Architect

## **2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES**

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors: SDI A250.8, Level 3.
  - 1. Physical Performance: SDI A250.4, Level A.
  - 2. Type: As indicated in the Door and Frame Schedule.
  - 3. Thickness: 1-3/4 inches
  - 4. Face: Metallic-coated steel sheet, minimum thickness of 0.053-inch, with minimum A60 coating.
  - 5. Edge Construction: Model 2, Seamless construction by continuous wire weld.
  - 6. Core: Polystyrene.
  - 7. Rated Core: Manufacturer's standard core for fire-rated doors
  - 8. Exposed Finish: Prime.
- C. Maximum-Duty Frames:
  - 1. Physical Performance: SDI A250.4, Level A.
  - 2. Materials: Metallic-coated steel sheet, minimum thickness of 0.067-inch, with minimum A60 coating.
  - 3. Construction: Full profile welded. Welded frames shall be ground smooth flush with neatly mitered or butted material cuts. Re-prime welded areas.
  - 4. Exposed Finish: Prime.
- D. Grout:
  - 1. Grout all frames 2'-0" above finished floor with approved non-shrink material and include rebar dowel. Solid grout frames in masonry walls full height.

## **2.5 BORROWED LITES AND HOLLOW-METAL PANELS**

- A. Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

## 2.6 FRAME ANCHORS

- A. Jamb Anchors:
  - 1. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
  - 2. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042-inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.188-inch thick.
  - 3. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042-inch thick.
  - 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor. Formed from same material as frames, minimum thickness of 0.051-inch. Provide 2 fasteners welded to the bottom of each jamb and as follows:
  - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
  - 2. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

## 2.7 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Zcoating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured

according to ASTM C 143/C 143M.

- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Section 08 80 00 "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## **2.8 FABRICATION**

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
  - 1. Fire Door Cores: As required to provide fire-protection ratings indicated.
  - 2. Vertical Edges for Single-Acting Doors: Bevel edges 1/8-inch in 2 inches. Both hinge edge and lock edge channels to be welded to each face sheet of door.
    - a. Door lock edge reinforcing shall be one-piece, full height 14 gage channel.
    - b. Door hinge edge reinforcing shall be one-piece full height 12 gage channel formed and tapped for hinges, or as required per hardware.
  - 3. Top Edge Closures: Close top edges of doors with flush closures of 16 gage steel welded to face sheets.
  - 4. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of 16 gage steel welded to face sheets.
  - 5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration. Close tops of exterior doors flush by the addition of 16 gage galvanized steel channel fillers sealed watertight.
  - 6. Astragals: Provide flat security type or 'Z' overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4-inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- C. Hollow-Metal Frames: Fabricate in one piece unless shipping or handling limitations dictate fabrication in sections. Where frames are fabricated in sections, minimize sections, and provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
  - 1. Sidelite and Transom Bar Frames: Provide closed tubular members with no



- visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
2. Welded frame units are to be delivered to job site as single units. Transoms, sidelights, and window walls which are oversized for transportation, shall be furnished with splices and assembled in the field.
  3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated. Screws are allowed only on the non-secure side and shall not be visible when viewing door lite frame face.
  4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be built into masonry or grouted in full.
  5. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
  6. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
      - 1) Two anchors per jamb up to 60 inches high.
      - 2) Three anchors per jamb from 60 to 90 inches high.
      - 3) Four anchors per jamb from 90 to 120 inches high.
      - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
    - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 24 inches o.c. and as follows:
      - 1) Three anchors per jamb up to 60 inches high.
      - 2) Four anchors per jamb from 60 to 90 inches high.
      - 3) Five anchors per jamb from 90 to 96 inches high.
      - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
    - c. Compression Type: Not less than two anchors in each frame.
    - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
  7. Head Anchors: Two anchors per head for frames installed in metal-stud walls, and three or more anchors in frame widths exceeding 42 inches. Spot weld to each jamb and extend to structure where indicated on Drawings.
  8. Head Struts: For frames not anchored to masonry or concrete construction, provide ceiling struts spot welded to jambs each side extending to building structure where indicated on Drawings.
  9. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
  10. Terminated Stops: Terminate stops [6 inches] above finish floor with a [45] and [90]-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
  - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
  - 2. Comply with BHMA A156.115 for preparation of hollow-metal work for hardware. Provide minimum thickness hardware reinforcing for mortise or surface applied hardware as follows:
    - a. Hinge 0.138-inch or equivalent number of threads on doors.
    - b. Hinge 0.180-inch on frames for mortise hinges.
    - c. Continuous hinges 0.108-inch full length.
    - d. Locks 0.108-inch or equivalent number of threads.
    - e. Panic Devices 0.108-inch.
    - f. Surface Closer 0.078-inch.
    - g. Hold Open Arm 0.108-inch.
    - h. Closer 0.078-inch channel type.
  - 3. Through-bolts (SNB) are not permitted.
  - 4. Do not include unnecessary cutouts in door faces not required by hardware template.
- F. Glazed Lites: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
  - 1. Window frame glass stops shall be a minimum 0.0516-inch steel and 5/8-inch in height. Exterior stops and countersunk flat-head screws to be galvanized.
  - 2. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
  - 3. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
  - 4. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
  - 5. Provide loose stops and moldings on inside of hollow-metal work.
  - 6. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

## **2.9 STEEL FINISHES**

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
  - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- B. Painted Finish: Provide manufacturer's standard paint finish.

## **2.10 ACCESSORIES**

- A. Louvers: Provide insert type louvers for interior doors, where indicated, which comply with SDI 111, with blades or baffles formed of 0.040-inch-thick, cold-rolled steel sheet set into 0.040-inch-thick steel frame. Louvers and frames to be prime coated.
  - 1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
  - 2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other.
  - 3. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.
- B. Provide high vents on restroom doors to prevent suction due to exhaust air.
- C. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- D. Grout Guards: Formed from same material as frames, not less than 0.016-inch thick.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with SDI A250.11.
  - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and without damage to completed Work.
    - a. At fire-rated openings, install frames according to NFPA 80.
    - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - c. Install frames with removable stops located on secure side of opening.
    - d. Install door silencers in frames before grouting.
    - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
  - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
  - 3. Solidly pack mineral-fiber insulation inside frames.
  - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
  - 5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  - 6. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
  - 7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
    - a. Squareness: Plus or minus 1/16-inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16-inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16-inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below.
  - 1. Install hollow metal doors in frames using hardware specified in Section 08 71 00 "Door Hardware". Install securely without marking or defacing hardware or finish work. Protect hardware finishes with suitable protective covering until completion of building.
  - 2. Doors are to be expertly hung and shall fit snug against all stops. After hanging, make all adjustments and remove respective hardware for finish painting where

- required. Reinstall hardware after finish painting.
3. Non-Fire-Rated Steel Doors:
    - a. Between Door and Frame Jambs and Head: 1/8-inch plus or minus 1/32-inch.
    - b. Between Edges of Pairs of Doors: 1/8-inch to 1/4-inch plus or minus 1/32-inch.
    - c. At Bottom of Door without Thresholds: 5/8-inch plus or minus 1/32-inch.
    - d. Between Door Face and Stop: 1/16-inch to 1/8-inch plus or minus 1/32-inch.
  4. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
  5. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
- D. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with hollow-metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

### **3.4 ADJUSTING AND CLEANING**

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove dirt, grout, excess sealant, glazing compounds, mortar and other bonding material from hollow-metal work immediately after installation. Fill all dents and holes with metal filler and sand smooth and flush with adjacent surfaces. Reprime and paint to match finish. Clean and polish.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

### **END OF SECTION**

**SECTION 08 14 16**  
**FLUSH WOOD DOORS**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Solid-core doors with hardwood-veneer faces.
- B. Related Requirements:
  - 1. Section 08 71 00 "Door Hardware" for door hardware for flush wood doors.
  - 2. Section 09 91 23 "Interior Painting" and Section 09 93 00 "Staining and Transparent Finishing" for field finishing doors.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
  - 1. Dimensions and locations of blocking.
  - 2. Dimensions and locations of mortises and holes for hardware.
  - 3. Dimensions and locations of cutouts.
  - 4. Undercuts.
  - 5. Face veneer pattern and species.
  - 6. Requirements for veneer matching.
  - 7. Fire-protection ratings for fire-rated doors.
  - 8. Glazing materials and thickness.
- C. Door Schedule: Indicate opening identifying symbol, size, door type and grade, elevations, light cutouts, swing, undercuts, and fire-classification markings.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Sample Warranty: For special warranty.

- B. Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.
- C. Certification of Label Construction: For labeled doors, certificate from nationally recognized testing agency stating that component construction conforms to UL rating requirements for the label indicated.
- D. Qualification Data: For Manufacturer, Supplier, and Installer.

## **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A Manufacturer qualified to produce doors that meet the current WDMA I.S. 1A Industry Standard for Architectural Wood Flush Doors.
- B. Supplier Qualifications: Supplier shall be a qualified direct distributor of the manufacturer's products. The Supplier shall have in its regular employment a person who is currently certified by DHI as an Architectural Hardware Consultant (AHC) or a Certified Door Consultant (CDC). The Supplier shall be available at reasonable times throughout the Project for consultation with Contractor, Architect, and District Construction Manager. The Supplier shall be available for in-person on-site consultation within 48 hours of first notice.
- C. Installer Qualifications: Firm with a minimum of five years' experience in the installation of flush wood doors and frames similar to the type required for this Project.
- D. The District Construction Manager may select not more than two doors at random for dismantling and inspection of internal construction for compliance with Project Specifications. Provide doors, labor, and tools for inspection under the District Construction Manager's supervision, at Contractor's expense.
- E. Failure of any flush wood door to comply with specified requirements shall be grounds to reject the entire shipment of flush wood doors, as well as to reject the Manufacturer. Items shall be replaced at Contractor's expense, including two additional doors for dismantling and inspection. No extensions of time or additions to the Contract amount will be allowed due to a rejection of material and substitution of the flush wood door Manufacture.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver doors wrapped in Manufacturer's original unopened protective covering, clearly marked with Manufacturer's name, brand name, and identifying number on the container. Mark each door on top rail with opening number corresponding with the shop drawings and door schedule.
- B. Store and protect doors in accordance with Manufacturer's recommendations and WDMA I.S. 1A.
  - 1. Store doors flat and palletized on a level surface in a dry, well-ventilated space.
  - 2. Keep doors at least 4-inches off the floor with protective coverings under the bottom and over the top of stack. Covering shall protect doors from dirt, water

- and abuse but allow air circulation under and around the stack.
3. Do not walk on or stack other materials on top of stacked doors.
  4. Do not allow doors to come in contact with water.
  5. Avoid exposure of interior doors to direct sunlight or extremes of heat or humidity.
  6. Always handle doors with clean dry hands or gloves.
  7. Always lift and carry doors. Do not drag doors.
  8. If cardboard containers become wet, remove and dry contents immediately.

## **1.7 FIELD CONDITIONS**

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.
  1. Doors shall be allowed to reach average prevailing temperature and humidity conditions within the area of installation for not less than 48 hours prior to installation.

## **1.8 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  1. Failures include:
    - a. Warping (bow, cup, or twist) more than 1/4-inch in a 42-by-84-inch section.
    - b. Telegraphing of core construction in face veneers exceeding 0.01-inch in a 3-inch span.
  2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
  3. Warranty Period for Solid-Core Interior Doors: Life of installation.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. VT Industries
  2. Algoma Hardwoods, Inc.
  3. Eggers Industries.
  4. Or Equal.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.



## **2.2 FLUSH WOOD DOORS, GENERAL.**

- A. Quality Standard: In addition to requirements specified, comply with WDMA I.S. 1A, "Architectural Wood Flush Doors."
  - 1. Provide WI Certified Compliance Labels indicating that doors comply with requirements of grades specified.
- B. WDMA I.S. 1A Performance Grade:
  - 1. Extra Heavy Duty.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C".
  - 1. Cores: Provide mineral core as needed to provide fire-protection rating indicated.
  - 2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
  - 3. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- D. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- E. Structural-Composite-Lumber-Core Doors:
  - 1. Structural Composite Lumber: WDMA I.S.10.
    - a. Screw Withdrawal, Face: 700 lbf.
    - b. Screw Withdrawal, Edge: 400 lbf.
- F. Mineral-Core Doors:
  - 1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
  - 2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as [needed to eliminate through-bolting hardware.] and [follows:]
  - 3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
    - a. Screw-Holding Capability: [550 lbf] per WDMA T.M.-10.

## **2.3 I.S. 1A VENEER-FACED DOORS FOR TRANSPARENT FINISH**

- A. Interior Solid-Core Doors <Insert drawing designation>:
  - 1. Grade: Premium, with Grade A faces.
  - 2. Species: White Birch.
  - 3. Cut: Plain sliced.
  - 4. Match between Veneer Leaves: Book match.
  - 5. Assembly of Veneer Leaves on Door Faces: Running match.
  - 6. Pair and Set Match: Provide for doors hung in same opening [or separated only]

7. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
8. Transom Match: Continuous match.
9. Exposed Vertical and Top Edges: Same species as faces or a compatible species - edge Type A.
10. Core: Structural composite lumber.
11. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.
12. Adhesives: Type II per WDMA T.M.-6.

## 2.4 LIGHT FRAMES AND LOUVERS

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
  1. Wood Species: Same species as door faces.
  2. Profile: [Flush rectangular beads].
  3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch-thick, cold-rolled steel sheet; [factory primed for paint] finish; and approved for use in doors of fire-protection rating indicated.
- C. Wood Louvers: Door manufacturer's standard solid-wood louvers unless otherwise indicated.
  1. Wood Species: Same species as door faces.
- D. Metal Louvers:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Air Louvers Inc.; a Division of the Activar Construction Products Group.
    - b. Anemostat Products; a Mestek company.
    - c. L & L Louvers, Inc.
    - d. Or Equal.
  2. Blade Type: [Vision-proof, inverted V].
  3. Metal and Finish: Extruded aluminum with Class II, clear anodic finish, AA-M12C22A31.
  4. Metal and Finish: Extruded aluminum with [light bronze], [medium bronze], [dark bronze], and [black], Class II, color anodic finish, AA-M12C22A32/A34.
- E. Louvers for Fire-Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Air Louvers Inc.; a Division of the Activar Construction Products Group.
    - b. Anemostat Products; a Mestek company.
    - c. L & L Louvers, Inc.
    - d. Or Equal.
  2. Metal and Finish: Hot-dip galvanized steel, 0.040-inch thick, [with baked-enamel-

or powder-coated] finish.

## **2.5 FABRICATION**

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  - 1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
  - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- C. Openings: Factory cut and trim openings through doors.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
  - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."
  - 3. Louvers: Factory install louvers in prepared openings.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
  - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Hardware: For installation, see Section 08 71 00 "Door Hardware."
- B. Handle doors per recommendations of WDMA I.S. 1A.
- C. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
  - 1. Install fire-rated doors according to NFPA 80.
  - 2. Install smoke- and draft-control doors according to NFPA 105.
- D. Drill properly sized pilot holes prior to the installation of door hardware to eliminate splits at door edges or face veneer damage.

- E. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
  - 1. Clearances: Provide 1/8-inch at heads, jambs, and between pairs of doors.  
Provide 1/8-inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4-inch from bottom of door to top of threshold unless otherwise indicated.
    - a. Comply with NFPA 80 for fire-rated doors.
    - b. Bevel non-fire-rated doors 1/8-inch in 2 inches at lock and hinge edges.
  - 2. Bevel fire-rated doors 1/8-inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- F. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- G. Field finished doors shall comply with WDMA I.S. 1A "Care and Handling at Job Site" instructions for field applied finishes.
- H. At completion of installation, doors shall be undamaged and all surfaces shall be in satisfactory condition for field finishing.
- I. Doors shall be installed to hang plumb and true in frames to contact stops uniformly.

### **3.3 ADJUSTING**

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged, that display wood splits in excess of 1/2-inch length at hardware locations, are hinge bound, do not swing or operate freely, or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.
- C. Adjust door hinges to provide uniform clearances at heads, jambs, and floor as indicated below and to contact frame silencers or stops uniformly. Perform these alterations only if doors are not factory pre-fit and pre-machined, or not fire-rated.
  - 1. Fit doors to width by planning equally from both sides.
  - 2. Bevel lock and hinge edges 1/8-inch in 2 inches.
  - 3. Side and top clearance: 1/8-inch.
  - 4. Floor clearance: 3/4-inch.
- D. Re-adjust door heights after carpet installation.

### **END OF SECTION**

## **SECTION 08 31 13**

### **ACCESS DOORS AND FRAMES**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Access doors and frames for walls and ceilings.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, materials, individual components and profiles, and finishes.
- B. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

##### **1.4 COORDINATION**

- A. Verification: Confirm specific locations and sizes for access doors needed to gain access to concealed equipment.

#### **PART 2 PRODUCTS**

##### **2.1 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Elmdor / Stoneman Manufacturing Company.
  - 2. Milcor; Commercial Products Group of Hart & Cooley, Inc.
  - 3. Nystrom, Inc.
  - 4. Williams Bros. Corporation of America (Exterior Louvered)
  - 5. Acudor Access Panels (Exterior Louvered)

6. Best Access Doors (Exterior Louvered)
  7. Or Equal.
- B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- C. Flush Access Doors with Exposed Flanges <Insert drawing designation>:
1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
  2. Locations: Wall and ceiling.
  3. Door Size: Refer to drawings.
  4. Uncoated Steel Sheet for Door: Nominal 0.060-inch, 16 gage.
    - a. Finish: Factory finish.
  5. Frame Material: Same material, thickness, and finish as door.
  6. Hinges: Continuous Type.
  7. Hardware: Lock.
- D. Exterior Flush Access Doors <Insert drawing designation>:
1. Assembly Description: Fabricate door to be weatherproof and fit flush to frame. Provide manufacturer's standard 2-inch-thick fiberglass insulation and extruded door gaskets. Provide manufacturer's standard-width frame for surface mounting, proportional to door size.
  2. Locations: Wall.
  3. Door Size: Refer to drawings.
  4. Steel Sheet for Door: [Nominal 0.064-inch, 14 gauge].
    - a. Finish: Factory prime.
  5. Frame Material: [Same material, and finish as door].
    - a. Minimum 16 gauge thickness.
  6. Hinges: Continuous Type.
  7. Hardware: Cylinder lock and key.
    - a. Provide a minimum of 3 keys. Confirm number with Owner prior to purchase.
- E. Hardware:
1. Latch (secured areas): Cam latch operated by screwdriver .
  2. Lock (unsecured areas): Cylinder.

## 2.2 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same type as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

## **2.3 FABRICATION**

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
  - 1. Provide mounting holes in frames for attachment of units to metal or wood framing.
  - 2. Provide mounting holes in frame for attachment of masonry anchors.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
  - 1. For cylinder locks, furnish two keys per lock and key all locks alike.
  - 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

## **2.4 FINISHES**

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Steel and Metallic-Coated-Steel Finishes:
  - 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
  - 2. Factory Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry-film thickness of 1-mil for topcoat.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

### **3.3 ADJUSTING**

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

**END OF SECTION**



## **SECTION 08 41 13**

### **ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Exterior storefront framing.
  - 2. Exterior manual-swing entrance doors .
- B. Related Requirements:
  - 1. Section 07 92 00 "Joint Sealants".
  - 2. Section 08 71 00 "Door Hardware".
  - 3. Section 08 80 00 "Glazing".

##### **1.3 COORDINATION**

- A. All electrified hardware, including exit devices, shall be by the same manufacturer throughout the project, including storefront entrances and gates. See section 08 71 00 "Door Hardware".

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
  - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
  - 2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
    - a. Joinery, including concealed welds.
    - b. Anchorage.

- c. Expansion provisions.
  - d. Glazing.
  - e. Flashing and drainage.
- 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
  - 1. Joinery, including concealed welds.
  - 2. Anchorage.
  - 3. Expansion provisions.
  - 4. Glazing.
  - 5. Flashing and drainage.
- F. Entrance Door Hardware Schedule
  - 1. Specified in section 08 71 00 Door "Hardware".
  - 2. Prepared under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.
  - 3. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
  - 4. Coordinate electrified door hardware to comply with single source manufacturer requirement specified in section 08 71 00 "Door Hardware".

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer and field testing agency.
- B. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Sample Warranties: For special warranties.

## **1.6 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

## **1.7 QUALITY ASSURANCE**

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

- B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
  - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- C. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code - Aluminum".
- D. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

## **1.8 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Noise or vibration created by wind and thermal and structural movements.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - d. Water penetration through fixed glazing and framing areas.
    - e. Failure of operating components.
  - 2. Warranty Period: Two years from date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
  - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, sway, and deflection from uniformly distributed and concentrated live loads.
  - 2. Failure also includes the following:
    - a. Thermal stresses transferring to building structure.
    - b. Glass breakage.
    - c. Noise or vibration created by wind and thermal and structural movements.

- d. Loosening or weakening of fasteners, attachments, and other components.
  - e. Failure of operating units.
- B. Structural Loads: As indicated on drawings and below.
- C. Deflection of Framing Members: At design wind pressure, as follows:
  - 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4-inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4-inch, whichever is less.
  - 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8-inch, whichever is smaller.
- D. Structural: Test according to ASTM E 330 as follows:
  - 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
  - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
  - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Dead Loads: Provide entrance and storefront-system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load.
  - 1. Provide a minimum 1/8-inch clearance between members and top of glazing or other fixed part immediately below.
  - 2. Provide a minimum 1/16-inch clearance between members and operable windows and doors.
- F. Live Loads: Provide entrance and storefront systems, including anchorage, that accommodate the supporting structures' deflection from uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.
- G. Wind Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of CBC or the ASCE 7, Minimum Design Loads for Buildings and Other Structures, 6.4.2, "Analytical Procedure," whichever are more stringent.
- H. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
  - 1. Fixed Framing and Glass Area:
    - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
  - 2. Entrance Doors:
    - a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

- b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
- I. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
  - 1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. Water leakage is defined as follows:
    - a. Uncontrolled water infiltrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.
- J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
  - 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
    - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
    - b. Low Exterior Ambient-Air Temperature: 0 deg F.
    - c. Interior Ambient-Air Temperature: 75 deg F.
- K. Glazing: Physically isolate glazing from framing members.
- L. Dimensional Tolerances: Provide entrance and storefront systems that accommodate dimensional tolerances of building frame and other adjacent construction.

## **2.2 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. EFCO Corporation.
  - 2. Kawneer North America; an Alcoa company.
  - 3. Oldcastle BuildingEnvelope™.
  - 4. Or Equal.
- B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing spandrel panels and venting windows and accessories, from single manufacturer.
- C. System: Kawneer Trifab VersaGlaze 601T (basis of design).

## 2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
  - 1. Construction: Thermally improved.
  - 2. Glazing System: Retained mechanically with gaskets on four sides.
  - 3. 2 inch x 6 inch frame.
  - 4. Glazing Plane: Center.
  - 5. Finish: Anodic finish selected by Architect from manufacturer's standard range.
  - 6. Fabrication Method: Field-fabricated stick system.
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Materials:
  - 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
    - a. Sheet and Plate: ASTM B 209.
    - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
    - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
    - d. Structural Profiles: ASTM B 308/B 308M.
  - 2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
    - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
    - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
    - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

## 2.4 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
  - 1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
  - 2. Door Design: As indicated.
  - 3. Glazing Stops and Gaskets: Manufacturer's standard snap-on, extruded-aluminum stops and preformed gaskets.
    - a. Provide non-removable glazing stops on outside of door.

## **2.5 ENTRANCE DOOR HARDWARE**

- A. General
  - 1. Hardware: Section 08 71 00 "Door Hardware."
- B. Weather Stripping: Manufacturer's standard replaceable components.
  - 1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
  - 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

## **2.6 GLAZING**

- A. Glazing: Comply with Section 08 80 00 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements.
- C. Glazing Sealants: Comply with Section 08 80 00 "Glazing."

## **2.7 ACCESSORIES**

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, non-bleeding fasteners and accessories compatible with adjacent materials.
  - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  - 2. Reinforce members as required to receive fastener threads.
  - 3. Do not use exposed fasteners, except for hardware application. For hardware application, use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1-inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
- C. Concealed Flashing: Dead-soft, 0.018-inch-thick stainless-steel, ASTM A 240/A 240M of type recommended by manufacturer.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

## **2.8 FABRICATION**

- A. Form or extrude aluminum shapes before finishing.

- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
  - 1. Profiles that are sharp, straight, and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered.
  - 3. Physical and thermal isolation of glazing from framing members.
  - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  - 5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Storefront Framing: Provide subframes and reinforcing of types indicated or, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.
- F. Entrance Door Frames: Fabricate door framing in profiles indicated. Reinforce as required to support loads imposed by door operation and for installing entrance door hardware. Cut, drill, and tap for factory-installed hardware before finishing components.
  - 1. At exterior doors, provide compression weather stripping at fixed stops.
  - 2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
  - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
  - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- I. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual".
- J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.9 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.



- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- D. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018-mm or thicker.
  - 1. Color: [As selected by Architect from full range of industry colors and color densities].

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

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

### **3.2 INSTALLATION**

- A. General:
  - 1. Comply with manufacturer's written instructions.
  - 2. Do not install damaged components.
  - 3. Fit joints to produce hairline joints free of burrs and distortion.
  - 4. Rigidly secure non-movement joints.
  - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
  - 6. Seal perimeter and other joints watertight unless otherwise indicated.
- B. Metal Protection:
  - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
  - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00 "Joint Sealants" to produce weathertight installation.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install operable units level and plumb, securely anchored, and without distortion.

Adjust weather-stripping contact and hardware movement to produce proper operation.

- F. Install glazing as specified in Section 08 80 00 "Glazing."
- G. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
- H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
  - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.

### **3.3 ERECTION TOLERANCES**

- A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
  - 1. Plumb: 1/8-inch in 10 feet; 1/4-inch in 40 feet.
  - 2. Level: 1/8-inch in 20 feet; 1/4-inch in 40 feet.
  - 3. Alignment:
    - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2-inch wide, limit offset from true alignment to 1/16-inch.
    - b. Where surfaces are separated by reveal or protruding element from 1/2- to 1-inch wide, limit offset from true alignment to 1/8-inch.
    - c. Where surfaces are separated by reveal or protruding element of 1-inch wide or more, limit offset from true alignment to 1/4-inch.
    - d. Diagonal Measurements: Limit difference between diagonal measurements to 1/8-inch.
  - 4. Location: Limit variation from plane to 1/8-inch in 12 feet; 1/2-inch over total length.

### **3.4 ADJUSTING AND CLEANING**

- A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.
- B. Remove excess sealant and glazing compounds and dirt from surfaces.

### **3.5 PROTECTION**

- A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

### **3.6 MAINTENANCE SERVICE**

#### **A. Entrance Door Hardware:**

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

**END OF SECTION**

**SECTION 08 51 13**  
**ALUMINUM WINDOWS**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section includes aluminum windows for exterior locations.
- B. Related Requirements:
  - 1. Section 07 92 00 "Joint Sealants".
  - 2. Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.
- B. Shop Drawings: For aluminum windows.
  - 1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples: For each exposed product and for each color specified, 2-by-4 inches in size.
- D. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For manufacturer and Installer.
- B. Sample Warranties: For manufacturer's warranties.

## **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports, and calculations.
- B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

## **1.6 WARRANTY**

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
  - 1. Failures include:
    - a. Failure to meet performance requirements.
    - b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
    - c. Faulty operation of movable sash and hardware.
    - d. Deterioration of materials and finishes beyond normal weathering.
    - e. Failure of insulating glass.
  - 2. Warranty Period:
    - a. Window: Two years from date of Substantial Completion.
    - b. Glazing Units: Ten years from date of Substantial Completion.
    - c. Aluminum Finish: Three years from date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

### **2.2 WINDOW PERFORMANCE REQUIREMENTS**

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
  - 1. Window Certification: AMMA certified with label attached to each window.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
  - 1. Minimum Performance Class: CW <Insert class>.
  - 2. Minimum Performance Grade: 30<Insert grade>.
- C. Thermal Transmittance: Refer to T-24 documentation.
- D. Solar Heat-Gain Coefficient (SHGC): Refer to T-24 documentation.

- E. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F material surfaces.

## **2.3 ALUMINUM WINDOWS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Arcadia, Inc.
  - 2. EFCO Corporation.
  - 3. Fleetwood Windows & Doors.
  - 4. Winco Windows.
  - 5. Or Equal.
- B. Operating Types: Provide the following operating types in locations indicated on Drawings:
  - 1. Fixed.
- C. Frames and Sashes: Aluminum extrusions complying with AAMA / WDMA / CSA 101 / I.S.2 / A440.
  - 1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.
- D. Insulating-Glass Units: ASTM E 2190.
  - 1. Glass: ASTM C 1036, Type 1, Class 1, q3.
    - a. Tint: Clear <Insert tint>.
    - b. Kind: Fully tempered where indicated on Drawings.
  - 2. Lites: Two.
  - 3. Filling: Fill space between glass lites with air.
  - 4. Low-E Coating: Manufacturer's standard.
- E. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal <Insert glazing requirements>.
  - 1. Dual Glazing:
    - a. Interior Lite: Glass.
    - b. Exterior Lite: Glass.
- F. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- G. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
  - 1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware

being fastened.

## **2.4 ACCESSORIES**

- A. Column Covers: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.
- B. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.
- C. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.
- D. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

## **2.5 FABRICATION**

- A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
- B. Glaze aluminum windows in the factory.
- C. Provide units that are reglazable without dismantling sash or ventilator framing.
- D. Weather strip each operable sash to provide weathertight installation.
- E. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- F. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.
- G. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design wind loads of window units.
- H. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

## **2.6 GENERAL FINISH REQUIREMENTS**

- A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a

strippable, temporary protective covering before shipping.

- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## **2.7 ALUMINUM FINISHES**

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018-mm or thicker) complying with AAMA 611.
  - 1. Color: [As selected by Architect from full range of industry colors and color densities].

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Install windows and components to drain condensation, water penetrating joints, and



moisture migrating within windows to the exterior.

- D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

### **3.3 ADJUSTING, CLEANING, AND PROTECTION**

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
  - 1. Keep protective films and coverings in place until final cleaning.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

### **END OF SECTION**

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

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Door hardware.
  - 2. Storefront and entrance door hardware.
  - 3. Cylinders for doors fabricated with locking hardware.
- B. Related Divisions:
  - 1. Division 06 – door hardware installation
  - 2. Division 07 – Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
  - 3. Division 08 – metal doors and frames, wood doors, storefront and glazed curtainwall systems.
  - 4. Division 10 – operable partitions.
- C. Specific Omissions: Hardware for the following is specified or indicated elsewhere.
  - 1. Windows.
  - 2. Cabinets, including open wall shelving and locks.
  - 3. Signs.
  - 4. Toilet accessories, including grab bars.
  - 5. Installation.
  - 6. Rough hardware.
  - 7. Access doors and panels.

#### **1.2 REFERENCES:**

- A. Use date of standard in effect as of Bid date.
  - 1. American National Standards Institute
    - a) ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties.
  - 2. BHMA – Builders Hardware Manufacturers Association
  - 3. 2022 California Building Code.
    - a) Chapter 11B – Accessibility To Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
  - 4. DHI – Door and Hardware Institute.
  - 5. UL – Underwriters Laboratories
    - a) UL 305 – Panic Hardware
  - 6. WHI – Warnock Hersey Incorporated State of California Building Code
  - 7. Local applicable codes

8. SDI – Steel Door Institute
9. WI – Woodwork Institute
10. AWI – Architectural Woodwork Institute
11. NAAMM – National Association of Architectural Metal Manufacturers

B. Abbreviations

1. Manufacturers: see table at 2.1.A of this section.
2. Finishes: see 2.7 of this section.

### 1.3 SUBMITTALS & SUBSTITUTIONS

- A. SUBMITTALS: Submit electronic copy of schedule. Organize vertically formatted schedule into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Minimum 10pt font size. Include following information:
1. Type, style, function, size, quantity, and finish of hardware items.
  2. Use BHMA Finish codes per ANSI A156.18.
  3. Name, part number and manufacturer of each item.
  4. Fastenings and other pertinent information.
  5. Location of hardware set coordinated with floor plans and door schedule.
  6. Explanation of abbreviations, symbols, and codes contained in schedule.
  7. Mounting locations for hardware.
  8. Door and frame sizes, materials, and degrees of swing.
  9. List of manufacturers used and their nearest representative with address and phone number.
  10. Catalog cuts.
- B. Bid and submit manufacturer’s updated/improved item if scheduled item is discontinued.
- C. Deviations: Highlight, encircle or otherwise identify deviations from “Schedule of Finish Hardware” on submittal with notations clearly designating those portions as deviating from this section.
- D. If discrepancy between drawings and scheduled material in this section, bid the more expensive of the two choices, note the discrepancy in the submittal and request direction from Architect for resolution.
- E. Substitutions per Division 1. Include product data and indicate benefit to the Project. Furnish operating samples on request.
- F. Items listed with no substitute manufacturers have been requested by Owner to meet existing standard.
- G. Furnish as-built/as-installed schedule with closeout documents, including keying schedule, riser and point-to-point wiring diagrams, manufacturers’ installation, adjustment and maintenance information, and supplier’s final inspection report.

### 1.4 QUALITY ASSURANCE:

- A. Qualifications:

1. Hardware supplier: direct factory contract supplier who employs a hardware consultant, available at reasonable times during course of work for project hardware consultation to Owner, Architect and Contractor.
  - a) Responsible for detailing, scheduling, and ordering of finish hardware. Detailing implies that the submitted schedule of hardware is correct and complete for the intended function and performance of the openings.
- B. Hardware: Free of defects, blemishes, and excessive play. Obtain each kind of hardware (latch and locksets, exit devices, hinges, and closers) from one manufacturer.
- C. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.
- D. Furnish hardware items required to complete the work in accordance with specified performance level and design intent, complying with manufacturers' instructions and code requirements.

#### 1.5 DELIVERY, STORAGE AND HANDLING:

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

#### 1.6 PROJECT CONDITIONS AND COORDINATION:

- A. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical the same operation and quality as type specified, subject to Architect's approval.
- B. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents. Furnish related trades with the following information:
  1. Location of embedded and attached items to concrete.
  2. Location of wall-mounted hardware, including wall stops. Note: Careful coordination required for reinforcement/blocking for wall stop support. If random inspection yields an unsupported wall stop, all locations will be rebuilt at no expense to the Owner or Architect.
  3. Location of finish floor materials and floor-mounted hardware.

4. At masonry construction, coordinate with the anchoring and hollow metal supplier prior to frame installation by placing a strip of insulation, wood, or foam, on the back of the hollow metal frame behind the rabbet section for continuous hinges, as well as at rim panic hardware strike locations, silencers, coordinators, and door closer arm locations. When the frame is grouted in place, the backing will allow drilling and tapping without dulling or breaking the installer's bits.
  5. Locations for conduit and raceways as needed for electrical, electronic, and electro-pneumatic hardware items. Fire/life-safety system interfacing. Point-to-point wiring diagrams plus riser diagrams to related trades.
  6. Coordinate: flush top rails of doors at out swinging exteriors, and throughout where adhesive-mounted seals occur.
  7. Manufacturers' templates to door and frame fabricators.
- C. Check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.
- D. Environmental considerations: segregate unused recyclable paper and paper product packaging, uninstalled metals, and plastics, and have these sent to a recycling center.

#### 1.7 WARRANTY:

- A. Part of respective manufacturers' regular terms of sale. Provide manufacturers' written warranties.
- B. Include factory order numbers with close-out documents to validate warranty information, required for Owner in making future warranty claims:
- C. Minimum warranties:
- |    |                   |                              |
|----|-------------------|------------------------------|
| 1. | Mortise Locksets: | Ten years mechanical         |
| 2. | Exit Devices:     | Ten years mechanical         |
| 3. | Closers:          | Twenty five years mechanical |
| 4. | Hinges:           | One year                     |
| 5. | Other Hardware    | Two years                    |

#### 1.8 COMMISSIONING:

- A. Conduct these tests prior to request for certificate of substantial completion:
1. With installer present, test door hardware operation with climate control system and stairwell pressurization system both at rest and while in full operation.

#### 1.9 REGULATORY REQUIREMENTS:

- A. Locate latching hardware between 34 inches to 44 inches above the finished floor, per-2022 California Building Code, Section 11B-404.2.7.

1. Panic hardware: locate between 36 inches to 44 inches above the finished floor.
- B. Handles, pull, latches, locks, other operable parts:
  1. Readily openable from egress side with one hand and without tight grasping, tight pinching, or twisting of the wrist to operate. 2022 California Building Code Section 11B-309.4.
  2. Force required to activate the operable parts: 5.0 pounds maximum, per 2022 California Building Code Section 11B-309.4.
- C. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2022 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.
  1. Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leaves or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.
- D. Adjust door closer sweep periods so that from an open position of 90 degrees, the door will take at least 5 seconds to move to a point 12 degrees from the latch, measured to the landing side of the door, per 2022 California Building Code Section 11B-404.2.8.
- E. Smooth surfaces at bottom 10 inches of push sides of doors, facilitating push-open with wheelchair footrests, per 2022 California Building Code Section 11B-404.2.10.
  1. Applied kickplates and armor plates: bevel the left and right edges; free of sharp or abrasive edges. Cavities created by kickplates to be capped per 2022 California Building Code Section 11B-404.2.10.
  2. Tempered glass doors without stiles: bottom rail may be less than 10 inches if top leading edge is tapered 60 degrees minimum.
- F. Door opening clear width no less than 32 inches, measured from face of frame stop, or edge of inactive leaf of pair of doors, to door face with door opened to 90 degrees. Hardware projection not a factor in clear width if located above 30 inches and below 80 inches, and the hardware projects no more than 4 inches. 2022 California Building Code Section 11B-404.2.3.
  1. Exception: In alterations, a projection of 5/8 inch (15.9 mm) maximum into the required clear width shall be permitted for the latch side stop.
  2. Door closers and overhead stops: not less than 78 inches above the finished floor or ground, per 2022 California Building Code 11B-307.4.
- G. Thresholds: floor or landing no more than 0.50 inches below the top of the threshold of the doorway, per 2022 California Building Code Section 11B-404.2.5. Vertical rise no more than 0.25 inches, change in level between 0.25 inches and 0.50 inches: beveled to slope no greater than 1:2 (50 percent slope). 2022 California Building Code Section 11B-303.2 & ~.3.
- H. Floor stops: Do not locate in path of travel. Locate no more than 4 inches from walls, per DSA Policy #99-08 (Access).

- I. Pairs of doors with independently activated hardware both leafs: limit swing of right-hand or right-hand-reverse leaf to 90 degrees to protect persons reading wall-mounted tactile signage, per 2022 California Building Code Section 11B-703.4.2.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS:

- A. Listed acceptable alternate manufacturers: these will be considered; submit for review products with equivalent function and features of scheduled products.

ITEM:	MANUFACTURER:	ACCEPTABLE ALTERNATE:
Hinges	(IVE) Ives	Bommer
Key System	(SCH) Schlage	Owner standard
Mechanical Locks	(SCH) Schlage	Owner standard
Exit Devices	(VON) Von Duprin	Owner standard
Closers	(LCN) LCN	Owner standard
Auto Flush Bolts	(TRM) Trimco	DCI, Ives
Coordinators	(TRM) Trimco	DCI, Ives
Push & Pull Plates	(TRM) Trimco	PDQ, Ives
Kickplates	(TRM) Trimco	Ives, PDQ
Stops & Holders	(TRM) Trimco	Ives, PDQ
Overhead Stops	(GLY) Glynn-Johnson	ABH
Thresholds	(ZER) Zero	NGP, Pemko
Seals & Bottoms	(ZER) Zero	NGP, Pemko

### 2.2 HINGING METHODS:

- A. Drawings typically depict doors at 90 degrees, doors will actually swing to maximum allowable. Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening. Advise architect if 8-inch width is insufficient.

- B. Conform to manufacturer's published hinge selection standard for door dimensions, weight and frequency, and to hinge selection as scheduled. Where manufacturer's standard exceeds the scheduled product, furnish the heavier of the two choices, notify Architect of deviation from scheduled hardware.
- C. Conventional Hinges: Steel or stainless-steel pins and approved bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.
  - 1. Out-swinging exterior doors: non-ferrous with non-removable (NRP) pins and security studs.
  - 2. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.

## 2.3 LOCKSETS, LATCHSETS, DEADBOLTS:

- A. Mortise Locksets and Latchsets: as scheduled.
  - 1. Chassis: cold-rolled steel, handing field-changeable without disassembly.
  - 2. Universal lock case – 10 functions in one case.
  - 3. Floating mounting tabs automatically adjusts to fit a beveled door edge.
  - 4. Latchbolts: 0.75 inch throw stainless steel anti-friction type.
  - 5. Lever Trim: through-bolted, accessible design, cast lever or solid extruded bar type levers as scheduled. Filled hollow tube design unacceptable.
    - a) Spindles: security design independent breakaway. Breakage of outside lever does not allow access to inside lever's hubworks to gain wrongful entry.
    - b) Inside lever applied by screwless shank mounting – no exposed trim mount screws.
    - c) Levers rotate up or down for ease of use.
  - 6. Furnish solid cylinder collars with wave springs. Wall of collar to cover rim of mortise cylinder.
  - 7. Turnpieces: accessible offset turn-lever design not requiring pinching or twisting motions to operate.
  - 8. Strikes: 16 gage curved steel, bronze or brass with 1-inch-deep box construction, lips of sufficient length to clear trim and protect clothing.
  - 9. Scheduled Lock Series and Design: Schlage L series, 06N design.
  - 10. Certifications:
    - a) ANSI A156.13, 1994, Grade 1 Operational.
    - b) ANSI/ASTM F476-84 Grade 31 UL Listed.
  - 11. Accessibility: Require not more than 5 lb to retract the latchbolt or deadbolt, or both, per CBC 2022 11B-404.2.7 and 11B-309.4.
  - 12. Accepted substitutions: None.

## 2.4 EXIT DEVICES / PANIC HARDWARE

- A. General features:



1. Independent lab-tested 1,000,000 cycles.
2. Push-through push-pad design. No exposed push-pad fasteners, no exposed cavities when operated. Return stroke fluid dampeners and rubber bottoming dampeners, plus anti-rattle devices.
3. Deadlocking latchbolts, 0.75-inch projection.
4. End caps: impact-resistant, flush-mounted. No raised edges or lips to catch carts or other equipment.
5. No exposed screws to show through glass doors.
6. Non-handed basic device design with center case interchangeable with all functions, no extra parts required to effect change of function.
7. Accessibility: Require not more than 5 lb. to retract the latchbolt, per CBC 2022 11B-404.2.7 and 11B-309.4.
  - a) Mechanical method: Von Duprin "AX - feature", where touchpad directly retracts the latchbolt with 5 lb. or less of force. Provide testing lab certification confirming that the mechanical device is independent third-party tested to meet this 5 lb. requirement.

B. Specific features:

1. Non-Fire Rated Devices: cylinder dogging with security indicator.
2. Lever Trim: breakaway type, forged brass or bronze escutcheon min. 0.130-inch thickness, compression spring drive, match lockset lever design.
3. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key. Furnish storage brackets for securely stowing the mullion away from the door when removed.
4. Accepted substitutions: None.

## 2.5 CLOSERS

A. Surface Closers: 4050A

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
3. Closer Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter heat-treated pinion journal and full complement bearings.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and all weather requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and back check.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide stick on templates, special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

9. Accepted substitutions: None.

## 2.6 OTHER HARDWARE

- A. Automatic Flush Bolts: Low operating force design.
- B. Overhead Stops: Non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.
- C. Kick Plates: Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.
- D. Door Stops: Provide stops to protect walls, casework, or other hardware.
  - 1. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where floor type cannot be used, provide wall type. If neither can be used, provide overhead type.
  - 2. Locate overhead stops for maximum possible opening. Consult with Owner for furniture locations. Minimum: 90deg stop / 95deg dead stop. Note degree of opening in submittal.
- E. Seals: Four-fingered type at head & jambs. Inelastic, rigid back, not subject to stretching. Self-compensating for warp, thermal bow, door settling, and out-of-plumb. Adhesive warranted for life of installation.
  - 1. Proposed substitutions: submit for approval.
  - 2. Three-fingered type at hinge jambs of doors fitted with continuous hinges where jamb leaf of hinge is fastened to the frame reveal.
- F. Thresholds: As scheduled and per details. Comply with CBC 2022 11B-404.2.5. Substitute products: certify that the products equal or exceed specified material's thickness. Proposed substitutions: submit for approval.
  - 1. Saddle thresholds: 0.125 inches minimum thickness.
  - 2. Exteriors: Seal perimeter to exclude water and vermin. Use sealant complying with requirements in Division 7 "Thermal and Moisture Protection". Minimum 0.25-inch diameter fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors. National Guard Products' "COMBO" or Pemko Manufacturing's "FHSL".
  - 3. Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.
  - 4. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws: full thread. Sleeve nuts: full length to prevent door compression.
- G. Through-bolts: Do not use. Coordinate with wood doors; ensure provision of proper blocking to support wood screws for mounting panic hardware and door closers. Coordinate with metal doors and frames; ensure provision of proper reinforcement to support machine screws for mounting panic hardware and door closers.

1. Exception: surface-mounted overhead stops, holders, and friction stays.

## 2.7 FINISH:

- A. Generally: BHMA 626 Satin Chromium.
  1. Areas using BHMA 626: furnish push-plates, pulls and protection plates of BHMA 630, Satin Stainless Steel, unless otherwise scheduled.
- B. Door closers: factory powder coated to match other hardware, unless otherwise noted.

## 2.8 KEYING REQUIREMENTS:

- A. Key System: (Verify with Owner) Schlage Everest utility-patented keyway, interchangeable core. 2029. Key blanks available only from factory-direct sources, not available from after-market key blank manufacturers. For estimate use factory GMK charge. Initiate and conduct meeting(s) with Owner and Allegion representatives to determine system keyway(s), keybow styles, structure and degree of geographic exclusivity. Furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner. Contractor will install permanent cylinders/cores.
- B. Keys
  1. Existing factory registered master key system.
  2. Construction keying: furnish temporary keyed-alike cores. Remove at substantial completion and install permanent cylinders/cores in Owner's presence. Demonstrate that construction key no longer operates.
  3. Furnish 10 construction keys.
  4. Furnish 2 construction control keys.
  5. Furnish 2 Emergency keys per each L9485 Faculty Restroom Lock
- C. Key Cylinders: furnish utility patented, 6-pin solid brass construction.
- D. Cylinder cores: furnish keyed at factory of lock manufacturer where permanent records are maintained. Locks and cylinders same manufacturer.
- E. Permanent keys: use secured shipment direct from point of origination to Owner.
  1. For estimate: 3 keys per change combination, 5 master keys per group, 5 grand-master keys, 3 control keys.
  2. For estimate: VKC stamping plus "DO NOT DUPLICATE".
  3. Bitting List: use secured shipment direct from point of origination to Owner upon completion.

## **PART 3 - EXECUTION**

### **3.1 ACCEPTABLE INSTALLERS:**

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

### **3.2 PREPARATION:**

- A. Ensure that walls and frames are square and plumb before hardware installation. Make corrections before commencing hardware installation. Installation denotes acceptance of wall/frame condition.
- B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.
  - 1. Notify Architect of code conflicts before ordering material.
  - 1. Locate latching hardware between 34 inches to 44 inches above the finished floor, per California Building Code, Section 1008.1.9.2 and 11B-404.2.7.
  - 2. Locate panic hardware between 36 inches to 44 inches above the finished floor.
- C. Overhead stops: before installing, determine proposed locations of furniture items, fixtures, and other items to be protected by the overhead stop's action.

### **3.3 INSTALLATION**

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

- C. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
- D. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- E. Locate overhead stops for minimum 90 degrees at rest and for maximum allowable degree of swing.
- F. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants".
- G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- H. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- I. Drill pilot holes for fasteners in wood doors and/or frames.

### 3.4. ADJUSTING

- A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.
  - 1. Hardware damaged by improper installation or adjustment methods: repair or replace to Owner's satisfaction.
  - 2. Adjust doors to fully latch with no more than 1 pound of pressure.
    - a) Door closer valves: turn valves clockwise until at bottom – do not force. Turn valves back out one and one-half turns and begin adjustment process from that point. Do not force valves beyond three full turns counterclockwise.
  - 3. Adjust door closers per 1.9 this section.
- B. Final inspection: Installer to provide letter to Owner that upon completion installer has visited the Project and has accomplished the following:
  - 1. Has re-adjusted hardware.
  - 2. Has evaluated maintenance procedures and recommend changes or additions and instructed Owner's personnel.
  - 3. Has identified items that have deteriorated or failed.
  - 4. Has submitted written report identifying problems.

### 3.5 DEMONSTRATION:

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

### 3.6 PROTECTION/CLEANING:

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

### 3.7 SCHEDULE OF FINISH HARDWARE

- A. See door schedule in drawings for hardware set assignments.
- B. Do not order material until submittal has been reviewed, stamped, and signed by Architect's door hardware consultant.
- C. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

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Legend:

 Link to catalog cut sheet
















 Electrified Opening

Hardware Group No. 001

For use on Door #(s):

203B

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 5 X 4.5 NRP		630	IVE
2	EA	POWER TRANSFER	EPT10 CON	 	689	VON
1	SET	AUTO FLUSH BOLT	3800 SERIES		626	TRM
1	EA	CLASSROOM SECURITY W/ INSIDE INDICATOR	L9071L 06N IS-LOC		626	SCH
2	EA	MORTISE CYLINDER	YALES - EXISTING FSIC		626	YAL
2	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	DUST PROOF STRIKE	3910/3910N /3911		630	TRM
1	EA	COORDINATOR X FILLER BAR X BRACKETS	3094 SERIES		600	TRM
2	EA	MOUNTING BRACKET	3095/3096		689	TRM
2	EA	OH STOP	100S		630	GLY
2	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
2	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)		AA	ZER
1	EA	OVERLAPPING ASTRAGAL	44STST 188SBK PSA		STST	ZER
2	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	103A OR AS DETAILED		A	ZER
2	EA	DOOR CONTACT	679 SERIES	 	BLK	SCE

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL  
DISTRICT LOCKSMITH

DOOR CONTACT

EPT10 CON FOR FUTURE ACCESS CONTROL











PROVIDE INFRASTRUCTURE FOR FUTURE INSTALLATION OF ACCESS CONTROL PER DETAIL

Hardware Group No. 002

For use on Door #(s):

119A                  119B                  120A                  120B                  121                  124  
125

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW SH 4.5 X 4.5 NRP		630	IVE
1	EA	POWER TRANSFER	EPT10 CON	 ⚡	689	VON
1	EA	CLASSROOM SECURITY W/ INSIDE INDICATOR	L9071L 06N IS-LOC		626	SCH
2	EA	MORTISE CYLINDER	YALES - EXISTING FSIC		626	YAL
2	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	EA	LOCK GUARD	5000		630	TRM
1	EA	Floor Stop - Round	7280		626/63 0	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)		AA	ZER
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	103A OR AS DETAILED		A	ZER
1	EA	DOOR CONTACT	679 SERIES	 ⚡	BLK	SCE

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL  
DISTRICT LOCKSMITH

DOOR CONTACT

EPT10 CON FOR FUTURE ACCESS CONTROL

PROVIDE INFRASTRUCTURE FOR FUTURE INSTALLATION OF ACCESS CONTROL PER DETAIL













Hardware Group No. 004

For use on Door #(s):

209 210 211

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	POWER TRANSFER	EPT10 CON	 ✎	689	VON
1	EA	PANIC HARDWARE	CDSI-PA-AX-98-NL-OP-110MD		626	VON
1	EA	RIM CYLINDER	YALES - EXISTING FSIC		626	YAL
1	EA	MORTISE CYLINDER	YALES - EXISTING FSIC		626	YAL
2	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	ANTI VANDAL PULL	1097 VD98-99 (NL-OP)		630	TRM
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	EA	Floor Stop - Round	7280		626/63 0	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)		AA	ZER
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	103A OR AS DETAILED		A	ZER
1	EA	DOOR CONTACT	679 SERIES	 ✎	BLK	SCE

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL

DISTRICT LOCKSMITH

DOOR CONTACT

EPT10 CON FOR FUTURE ACCESS CONTROL











PROVIDE INFRASTRUCTURE FOR FUTURE INSTALLATION OF ACCESS CONTROL PER DETAIL

Hardware Group No. 005

For use on Door #(s):

100E 100F

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW SH 4.5 X 4.5 NRP		630	IVE
1	EA	POWER TRANSFER	EPT10 CON	 ✎	689	VON
1	EA	PANIC HARDWARE	CDSI-PA-AX-98-NL-OP-110MD		626	VON
1	EA	RIM CYLINDER	YALES - EXISTING FSIC		626	YAL
1	EA	MORTISE CYLINDER	YALES - EXISTING FSIC		626	YAL
2	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	ANTI VANDAL PULL	1097 VD98-99 (NL-OP)		630	TRM
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	EA	Floor Stop - Round	7280		626/63 0	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)		AA	ZER
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	103A OR AS DETAILED		A	ZER
1	EA	DOOR CONTACT	679 SERIES	 ✎	BLK	SCE

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL  
DISTRICT LOCKSMITH

DOOR CONTACT

EPT10 CON FOR FUTURE ACCESS CONTROL











PROVIDE INFRASTRUCTURE FOR FUTURE INSTALLATION OF ACCESS CONTROL PER DETAIL

Hardware Group No. 006

For use on Door #(s):

105B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	POWER TRANSFER	EPT10 CON	 ⚡	689	VON
1	EA	OFFICE/ENTRY LOCK W/ INSIDE INDICATOR	L9050T 06N L583-363 IS-LOC		626	SCH
2	EA	MORTISE CYLINDER	YALES - EXISTING FSIC		626	YAL
2	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	EA	Floor Stop - Round	7280		626/63 0	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)		AA	ZER
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	103A OR AS DETAILED		A	ZER
1	EA	DOOR CONTACT	679 SERIES	 ⚡	BLK	SCE

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL  
DISTRICT LOCKSMITH

DOOR CONTACT

EPT10 CON FOR FUTURE ACCESS CONTROL














PROVIDE INFRASTRUCTURE FOR FUTURE INSTALLATION OF ACCESS CONTROL PER DETAIL

Hardware Group No. 007

For use on Door #(s):

100A

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
2	EA	POWER TRANSFER	EPT10 CON	 ✎	689	VON
1	EA	REMOVABLE MULLION	KR4954		689	VON
1	EA	PANIC HARDWARE	CDSI-PA-AX-98-EO		626	VON
1	EA	PANIC HARDWARE	CDSI-PA-AX-98-NL-OP-110MD		626	VON
1	EA	RIM CYLINDER	YALES - EXISTING FSIC		626	YAL
2	EA	MORTISE CYLINDER	YALES - EXISTING FSIC		626	YAL
4	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	MORTISE CYLINDER (MULLION)	YALES -EXISTING FSIC		626	YAL
1	EA	ANTI VANDAL PULL	1097 VD98-99 (EXIT ONLY)		630	TRM
1	EA	ANTI VANDAL PULL	1097 VD98-99 (NL-OP)		630	TRM
2	EA	OH STOP	100S		630	GLY
2	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
2	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)		AA	ZER
1	EA	MULLION SEAL	8780NBK PSA		BK	ZER
2	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	103A OR AS DETAILED		A	ZER
2	EA	DOOR CONTACT	679 SERIES	 ✎	BLK	SCE

WEATHER SEAL AND EDGE SEAL BY ALUMINUM STOREFRONT DOOR AND FRAME  
MANUFACTURER

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL  
DISTRICT LOCKSMITH

DOOR CONTACT










PROVIDE INFRASTRUCTURE FOR FUTURE INSTALLATION OF ACCESS CONTROL PER DETAIL  
EPT10 CON FOR FUTURE ACCESS CONTROL

Hardware Group No. 008

For use on Door #(s):

204A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	ELEC PRIVACY LOCK	CO-100-MS-40-KP-RHO-JYA7 4B		✂ 626	SCE
			BATTERY OPERATED			
1	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA		626	YAL
			KEYWAY			
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)		AA	ZER
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	103A OR AS DETAILED		A	ZER
1	EA	DOOR CONTACT	679 SERIES		✂ BLK	SCE














NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL  
DISTRICT LOCKSMITH  
DOOR CONTACT

Hardware Group No. 009

For use on Door #(s):

132 213

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
2	EA	POWER TRANSFER	EPT10 CON	 ✎	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
1	EA	PANIC HARDWARE	LD-PA-AX-98-EO		626	VON
1	EA	PANIC HARDWARE	LD-PA-AX-98-NL-OP-110MD		626	VON
1	EA	MULLION STORAGE KIT	MT54		689	VON
1	EA	RIM CYLINDER	YALES - EXISTING FSIC		626	YAL
2	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	MORTISE CYLINDER (MULLION)	YALES -EXISTING FSIC		626	YAL
1	EA	ANTI VANDAL PULL	1097 VD98-99 (NL-OP)		630	TRM
2	EA	OH STOP	100S		630	GLY
2	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
2	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)		AA	ZER
1	EA	MULLION SEAL	8780NBK PSA		BK	ZER
2	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	103A OR AS DETAILED		A	ZER
2	EA	DOOR CONTACT	679 SERIES	 ✎	BLK	SCE

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL  
DISTRICT LOCKSMITH

DOOR CONTACT

PROVIDE INFRASTRUCTURE FOR FUTURE INSTALLATION OF ACCESS CONTROL PER DETAIL









EPT10 CON FOR FUTURE ACCESS CONTROL

Hardware Group No. 010

For use on Door #(s):

130

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	ACCESSIBLE STOREROOM LOCK	L9081J 06N		626	SCH
1	EA	MORTISE CYLINDER	YALES - EXISTING FSIC		626	YAL
1	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	EA	LOCK GUARD	5000		630	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)		AA	ZER
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	103A OR AS DETAILED		A	ZER











NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL  
DISTRICT LOCKSMITH

Hardware Group No. 011

For use on Door #(s):

212

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	POWER TRANSFER	EPT10 CON	 ⚡	689	VON
1	EA	ACCESSIBLE STOREROOM LOCK	L9081J 06N		626	SCH
1	EA	MORTISE CYLINDER	YALES - EXISTING FSIC		626	YAL
1	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	EA	LOCK GUARD	5000		630	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)		AA	ZER
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	103A OR AS DETAILED		A	ZER
1	EA	DOOR CONTACT	679 SERIES	 ⚡	BLK	SCE

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL  
DISTRICT LOCKSMITH

DOOR CONTACT

PROVIDE INFRASTRUCTURE FOR FUTURE INSTALLATION OF ACCESS CONTROL PER DETAIL  
EPT10 CON FOR FUTURE ACCESS CONTROL

Central Valley CHS

Shafter, CA

DSA Submittal - Feb. 27, 2026

DOOR HARDWARE

08 71 00 -22

Hardware Group No. 012

For use on Door #(s):

201A 201B 201C

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
2	EA	POWER TRANSFER	EPT10 CON		689	VON
1	EA	REMOVABLE MULLION	KR4954		689	VON
1	EA	PANIC HARDWARE	CDSI-PA-AX-98-EO		626	VON
1	EA	PANIC HARDWARE	CDSI-PA-AX-98-NL-OP-110MD		626	VON
1	EA	RIM CYLINDER	YALES - EXISTING FSIC		626	YAL
2	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	MORTISE CYLINDER (MULLION)	YALES -EXISTING FSIC		626	YAL
1	EA	ANTI VANDAL PULL	1097 VD98-99 (EXIT ONLY)		630	TRM
1	EA	ANTI VANDAL PULL	1097 VD98-99 (NL-OP)		630	TRM
2	EA	OH STOP	100S		630	GLY
2	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
2	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)		AA	ZER
1	EA	MULLION SEAL	8780NBK PSA		BK	ZER
2	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	103A OR AS DETAILED		A	ZER
2	EA	DOOR CONTACT	679 SERIES		BLK	SCE

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL  
DISTRICT LOCKSMITH

DOOR CONTACT

PROVIDE INFRASTRUCTURE FOR FUTURE INSTALLATION OF ACCESS CONTROL PER DETAIL

EPT10 CON FOR FUTURE ACCESS CONTROL

Hardware Group No. 013

For use on Door #(s):

100B 100D

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70JYA6D RHO		626	SCH
1	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4050A REG		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	EA	DOOR SEAL	188N (HEAD AND JAMBS)		BK	ZER

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL  
DISTRICT LOCKSMITH

Central Valley CHS

Shafter, CA

DSA Submittal - Feb. 27, 2026

DOOR HARDWARE

08 71 00 -23










Hardware Group No. 014

For use on Door #(s):

203A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70JYA6D RHO		626	SCH
1	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4050A REG		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	EA	MOP PLATE	MO050 4" X 1" LDW B-CS		630	TRM
1	EA	DOOR SEAL	188N (HEAD AND JAMBS)		BK	ZER











NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL DISTRICT LOCKSMITH

Hardware Group No. 015

For use on Door #(s):

202

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	POWER TRANSFER	EPT10 CON		689	VON
1	EA	CLASSROOM SECURITY W/ INSIDE INDICATOR	L9071L 06N IS-LOC		626	SCH
2	EA	MORTISE CYLINDER	YALES - EXISTING FSIC		626	YAL
2	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	EA	LOCK GUARD	5000		630	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)		AA	ZER
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	103A OR AS DETAILED		A	ZER
1	EA	DOOR CONTACT	679 SERIES		BLK	SCE

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL DISTRICT LOCKSMITH

DOOR CONTACT

PROVIDE INFRASTRUCTURE FOR FUTURE INSTALLATION OF ACCESS CONTROL PER DETAIL  
EPT10 CON FOR FUTURE ACCESS CONTROL

Central Valley CHS

Shafter, CA

DSA Submittal - Feb. 27, 2026

DOOR HARDWARE











08 71 00 -24

Hardware Group No. 015.2

For use on Door #(s):

205

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	POWER TRANSFER	EPT10 CON	 ✎	689	VON
1	EA	ACCESSIBLE STOREROOM LOCK	L9081J 06N		626	SCH
2	EA	MORTISE CYLINDER	YALES - EXISTING FSIC		626	YAL
2	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	EA	LOCK GUARD	5000		630	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)		AA	ZER
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	103A OR AS DETAILED		A	ZER
1	EA	DOOR CONTACT	679 SERIES	 ✎	BLK	SCE

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL

DISTRICT LOCKSMITH

DOOR CONTACT

PROVIDE INFRASTRUCTURE FOR FUTURE INSTALLATION OF ACCESS CONTROL PER DETAIL

EPT10 CON FOR FUTURE ACCESS CONTROL









Hardware Group No. 016

For use on Door #(s):

106

112

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	POWER TRANSFER	EPT10 CON	 ✎	689	VON
1	EA	CLASSROOM LOCK	ND70JYA6D RHO		626	SCH
1	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4050A REG		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	EA	DOOR SEAL	188N (HEAD AND JAMBS)		BK	ZER
1	EA	DOOR CONTACT	679 SERIES	 ✎	BLK	SCE

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL

DISTRICT LOCKSMITH

DOOR CONTACT

PROVIDE INFRASTRUCTURE FOR FUTURE INSTALLATION OF ACCESS CONTROL PER DETAIL

EPT10 CON FOR FUTURE ACCESS CONTROL

Central Valley CHS

Shafter, CA

DSA Submittal - Feb. 27, 2026

DOOR HARDWARE








08 71 00 -25

Hardware Group No. 017

For use on Door #(s):

101                      102                      103                      105A                      107                      110  
116                      104

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	POWER TRANSFER	EPT10 CON	 ✎	689	VON
1	EA	ENTRANCE/OFFICE LOCK	ND50JYA6D RHO		626	SCH
1	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	SURFACE CLOSER	4050A REG		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	EA	FLOOR STOP	1211		626	TRM
1	EA	DOOR SEAL	188N (HEAD AND JAMBS)		BK	ZER
1	EA	DOOR CONTACT	679 SERIES	 ✎	BLK	SCE

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL DISTRICT LOCKSMITH  
DOOR CONTACT








PROVIDE INFRASTRUCTURE FOR FUTURE INSTALLATION OF ACCESS CONTROL PER DETAIL  
EPT10 CON FOR FUTURE ACCESS CONTROL

Hardware Group No. 018

For use on Door #(s):

109                      114

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	POWER TRANSFER	EPT10 CON	 ✎	689	VON
1	EA	CLASSROOM LOCK	ND70JYA6D RHO		626	SCH
1	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	SURFACE CLOSER	4050A REG		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	EA	FLOOR STOP	1211		626	TRM
1	EA	DOOR SEAL	188N (HEAD AND JAMBS)		BK	ZER
1	EA	DOOR CONTACT	679 SERIES	 ✎	BLK	SCE

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL DISTRICT LOCKSMITH  
DOOR CONTACT










PROVIDE INFRASTRUCTURE FOR FUTURE INSTALLATION OF ACCESS CONTROL PER DETAIL  
EPT10 CON FOR FUTURE ACCESS CONTROL

Hardware Group No. 019

For use on Door #(s):

207 208

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		630	IVE
1	EA	POWER TRANSFER	EPT10 CON	 ✎	689	VON
1	EA	CLASSROOM SECURITY W/ INSIDE INDICATOR	L9071L 06N IS-LOC		626	SCH
2	EA	MORTISE CYLINDER	YALES - EXISTING FSIC		626	YAL
2	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	SURFACE CLOSER	4050A REG		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	EA	WALL BUMPER	1270CV		626	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)		AA	ZER
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	103A OR AS DETAILED		A	ZER
1	EA	DOOR CONTACT	679 SERIES	 ✎	BLK	SCE

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL  
DISTRICT LOCKSMITH

DOOR CONTACT







PROVIDE INFRASTRUCTURE FOR FUTURE INSTALLATION OF ACCESS CONTROL PER DETAIL  
EPT10 CON FOR FUTURE ACCESS CONTROL

Hardware Group No. 020

For use on Door #(s):

117

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ELEC PRIVACY LOCK	CO-100-CY-40-KP-RHO-JYA7 4B	 ✎	626	SCE
		BATTERY OPERATED				
1	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	EA	DOOR SEAL	188N (HEAD AND JAMBS)		BK	ZER

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL  
DISTRICT LOCKSMITH

Central Valley CHS

Shafter, CA

DSA Submittal - Feb. 27, 2026

DOOR HARDWARE











08 71 00 -27

Hardware Group No. 021

For use on Door #(s):

131

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	POWER TRANSFER	EPT10 CON	 ✎	689	VON
1	EA	ACCESSIBLE STOREROOM LOCK	L9081J 06N		626	SCH
1	EA	MORTISE CYLINDER	YALES - EXISTING FSIC		626	YAL
1	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	8400 12" X 2" LDW B-CS		630	IVE
1	EA	LATCH GUARD	5001		630	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)		AA	ZER
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	103A OR AS DETAILED		A	ZER
1	EA	DOOR CONTACT	679 SERIES	 ✎	BLK	SCE

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL

DISTRICT LOCKSMITH

DOOR CONTACT

PROVIDE INFRASTRUCTURE FOR FUTURE INSTALLATION OF ACCESS CONTROL PER DETAIL










EPT10 CON FOR FUTURE ACCESS CONTROL

Hardware Group No. 022

For use on Door #(s):

206

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1	EA	ELEC PRIVACY LOCK	CO-100-MS-40-KP-RHO-JYA7 4B	 ✎	626	SCE
			BATTERY OPERATED			
1	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4050A REG		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)		AA	ZER
1	EA	DOOR SWEEP	8192AA		AA	ZER
1	EA	THRESHOLD	103A OR AS DETAILED		A	ZER
1	EA	DOOR CONTACT	679 SERIES	 ✎	BLK	SCE

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL

DISTRICT LOCKSMITH

DOOR CONTACT

Central Valley CHS

Shafter, CA

DSA Submittal - Feb. 27, 2026

DOOR HARDWARE







08 71 00 -28

Hardware Group No. 023

For use on Door #(s):

113 115 204B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ELEC PRIVACY LOCK	CO-100-CY-40-KP-RHO-JYA7 4B	 ✎	626	SCE
			BATTERY OPERATED			
1	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA		626	YAL
			KEYWAY			
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	EA	DOOR SEAL	188N (HEAD AND JAMBS)		BK	ZER




NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL DISTRICT LOCKSMITH

Hardware Group No. 024

For use on Door #(s):

111

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50JYA6D RHO		626	SCH
1	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA		626	YAL
			KEYWAY			
1	EA	WALL BUMPER	1270CV		626	TRM
1	EA	DOOR SEAL	188N (HEAD AND JAMBS)		BK	ZER






NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL DISTRICT LOCKSMITH

Hardware Group No. 025

For use on Door #(s):

108

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ELEC PRIVACY LOCK	CO-100-CY-40-KP-RHO-JYA7 4B	 ✎	626	SCE
			BATTERY OPERATED			
1	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA		626	YAL
			KEYWAY			
1	EA	SURFACE CLOSER	4050A REG		689	LCN
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	EA	WALL BUMPER	1270CV		626	TRM
1	EA	DOOR SEAL	188N (HEAD AND JAMBS)		BK	ZER

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL DISTRICT LOCKSMITH

Central Valley CHS

Shafter, CA

DSA Submittal - Feb. 27, 2026

DOOR HARDWARE







08 71 00 -29

Hardware Group No. 026

For use on Door #(s):

123 122

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND81JYA6D RHO		626	SCH
1	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	8400 12" X 2" LDW B-CS		630	IVE
1	EA	DOOR SEAL	188N (HEAD AND JAMBS)		BK	ZER


NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL DISTRICT LOCKSMITH

Hardware Group No. 028

For use on Door #(s):

100C

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	INVISIBLE SPRING HINGE CLOSER	218IC		626	SOS
1	EA	CLASSROOM LOCK	ND70JYA6D RHO		626	SCH
1	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	WALL BUMPER	1270CV		626	TRM





NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL DISTRICT LOCKSMITH

Hardware Group No. G101

For use on Door #(s):

G01 G02

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1		CENTER FIXEDD POST MULLION	GATE FABRICATOR			B/O
1	EA	PANIC HARDWARE	OUT-PA-AX-98-EO-WH		630	VON
2	EA	PANIC HARDWARE	OUT-PA-AX-98-NL-OP-110MD-WH		630	VON
1	EA	RIM CYLINDER	YALES - EXISTING FSIC		626	YAL
2	EA	MORTISE CYLINDER	YALES - EXISTING FSIC		626	YAL
3	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	ANTI VANDAL PULL	1097 VD98-99 (EXIT ONLY)		630	TRM
1	EA	ANTI VANDAL PULL	1097 VD98-99 (NL-OP)		630	TRM
2	EA	SURECLOSE GATESTOP	7403 RF		600	TBD
2	EA	GATE CLOSER/HINGE	MAMOTH180-ZILV			LOX
2	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
2	EA	FLOOR STOP	7280		630	TRM

NEW CYLINDER TO MATCH EXISTING SCHOOL DISTRICT STANDARD - CONSULT SCHOOL DISTRICT LOCKSMITH

GATE FABRICATOR TO PROVIDE HINGE REINFORCEMENT FOR HINGE CLOSER AND RIM PANIC REINFORCEMENT AND MOUNTING PLATE

CENTER FIXED MULLION TO BE PROVIDED BY GATE FABRICATOR

CENTER DOOR LEAF SWING 90 DEGREE WITH SURECLOSE GATE STOP

Hardware Group No. G102

For use on Door #(s):

G05

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	LOCKING CANE BOLT	BY GATE MFGR./SUPPLIER			
1	EA	PADLOCK	21-KZWI RE-KEYABLE SERIES			MAS
1	EA	GATE LATCH	BY GATE MFGR./SUPPLIER			
2	EA	GATE HINGE	BY GATE MFGR./SUPPLIER			

MAINTENANCE GATE

ALL HARDWARE BY GATE FABRICATOR






Hardware Group No. G103

For use on Door #(s):

G04

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	PANIC HARDWARE	OUT-PA-AX-98-NL-OP-110MD-WH		626	VON
1	EA	RIM CYLINDER	YALES - EXISTING FSIC		626	YAL
1	EA	MORTISE CYLINDER	YALES - EXISTING FSIC		626	YAL
1	EA	IC CORE CYLINDER	YALES - EXISTING FSIC GA KEYWAY		626	YAL
1	EA	ANTI VANDAL PULL	1097 VD98-99 (NL-OP)		630	TRM
1	EA	GATE CLOSER/HINGE	MAMOTH180-ZILV			LOX
1	EA	KICK PLATE	K0050 10" X 2" LDW		630	TRM
1	EA	FLOOR STOP	7280		630	TRM

EXIT GATE

NEW CYLINDER TO MATCH EXISTING CAMPUS STANDARD - CONSULT CAMPUS LOCKSMITH  
GATE FABRICATOR TO PROVIDE HINGE REINFORCEMENT FOR HINGE CLOSER AND RIM PANIC  
REINFORCEMENT AND MOUNTING PLATE

Hardware Group No. G104

For use on Door #(s):

G03

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	LOCKING CANE BOLT	BY GATE MFGR./SUPPLIER			
1	EA	PADLOCK	21-KZWI RE-KEYABLE SERIES			MAS
1	EA	GATE LATCH	BY GATE MFGR./SUPPLIER			
2	EA	GATE HINGE	BY GATE MFGR./SUPPLIER			

VEHICULAR GATE

ALL HARDWARE BY GATE FABRICATOR

Hardware Group No. G105

For use on Door #(s):

G06

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	PADLOCK	21-KZWI RE-KEYABLE SERIES			MAS
1	EA	GATE LATCH	BY GATE MFGR./SUPPLIER			
4	EA	GATE HINGE	BY GATE MFGR./SUPPLIER			

TRASH ENCLOSURE

ALL HARDWARE BY GATE FABRICATOR

Central Valley CHS

Shafter, CA

DSA Submittal - Feb. 27, 2026

DOOR HARDWARE

08 71 00 -32

Hardware Group No. G106

For use on Door #(s):

G07

Provide each PR door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
	EXTERIOR VEHICULAR GATE TYPE 6			

**END OF SECTION**

## **SECTION 08 80 00**

### **GLAZING**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section includes:
  - 1. Glass for windows, doors, interior borrowed lites, storefront framing, and glazed entrances.
  - 2. Glazing sealants and accessories.

##### **1.3 DEFINITIONS**

- A. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- B. CBC: California Building Code.
- C. Interspace: Space between lites of an insulating-glass unit.

##### **1.4 COORDINATION**

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

##### **1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass the following products; 12 inches square.
  - 1. Tinted glass.
  - 2. Coated glass.
  - 3. Insulating glass.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and

location. Use same designations indicated on Drawings.

## **1.6 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer and manufacturers of insulating-glass units with sputter-coated, low-E coatings.
- B. Product Certificates: For glass.
- C. Sample Warranties: For special warranties.

## **1.7 QUALITY ASSURANCE**

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.
- B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

## **1.9 FIELD CONDITIONS**

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
  - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

## **1.10 WARRANTY**

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
  - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Kawneer.
  - 2. Oldcastle BuildingEnvelope™.
  - 3. PPG Industries, Inc.
  - 4. Or Equal.
- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- C. Obtain tinted glass from single source from single manufacturer.
- D. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
  - 1. Subject to compliance with requirements, permanently mark safety glass with

certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6-mm thick.
  2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
  3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
  4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
  5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

## **2.3 GLASS PRODUCTS, GENERAL**

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
  2. IGM Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IgCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum.
1. Minimum Glass Thickness for Exterior Lites: 6-mm.
  2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

## **2.4 GLASS PRODUCTS**

- A. Clear Annealed Float Glass: ASTM C 1036, Type I (transparent glass, flat); Class 1

(clear), Quality-Q3.

- B. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.
- C. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
  - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- D. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
  - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

## **2.5 COATED FLOAT GLASS**

- A. General: ASTM C 1048. Provide coated glass complying with requirements indicated in this Article and in schedules at the end of Part 3.
  - 1. Provide Kind HS (heat strengthened) coated float glass in place of coated annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass requirements specified in "Performance Requirements" Article.
  - 2. Provide Kind FT (fully tempered) products where coated safety glass is indicated.
- B. Sputter-Coated Float Glass: Float glass with metallic-oxide or metallic-nitride coating deposited by vacuum deposition process after manufacture and heat treatment.

## **2.6 INSULATING GLASS**

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
  - 1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in "Performance Requirements" Article.
  - 2. Provide Kind FT (fully tempered) where safety glass is indicated.
  - 3. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
  - 4. Perimeter Spacer: Manufacturer's standard spacer material and construction complying with the following requirements:
    - a. Aluminum with color-anodized finish to match frame finish.
  - 5. Desiccant: Molecular sieve or silica gel, or a blend of both.
  - 6. Corner Construction: Manufacturer's standard.
- B. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated in the Insulating-Glass Schedule at the end of Part 3 are nominal. The overall thickness of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.

## 2.7 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
  - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
  - 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Elastomeric Glazing Sealant Standard: Comply with ASTM C 920 and additional requirements indicated for single component silicone sealants.
  - 1. Movement Capability: Where movement capability is specified, provide products with the capability when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements in ASTM C 920 for uses indicated.
- C. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dow Corning Corporation.
    - b. Pecora Corp.
    - c. Tremco Incorporated.
    - d. Or Equal.
- D. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dow Corning Corporation.
    - b. Pecora Corporation.
    - c. Tremco Incorporated.
    - d. Or Equal.



## **2.8 GLAZING TAPES**

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
  - 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  - 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

## **2.9 GLAZING GASKETS**

- A. Soft Compression Gaskets: Extruded or molded, closed cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black, and of profile and hardness required to maintain watertight seal:
  - 1. EPDM.
  - 2. Silicone.
  - 3. Thermoplastic polyolefin rubber.

## **2.10 MISCELLANEOUS GLAZING MATERIALS**

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

## **2.11 FABRICATION OF GLAZING UNITS**

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
  - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
    - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 2. Presence and functioning of weep systems.
  - 3. Minimum required face and edge clearances.
  - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

### **3.3 GLAZING, GENERAL**

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

- C. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

### **3.4 TAPE GLAZING**

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

### **3.5 GASKET GLAZING (DRY)**

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

### **3.6 SEALANT GLAZING (WET)**

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant

performance.

- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### **3.7 CLEANING AND PROTECTION**

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface.
- B. Immediately after installation remove nonpermanent labels and clean surfaces.
- C. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
  - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

### **3.8 MONOLITHIC GLASS SCHEDULE**

- A. Glass Type : Uncoated Class I, (clear) fully tempered float glass.
  - 1. Minimum Thickness: 6-mm.
  - 2. Safety glazing required.

### **3.9 INSULATING GLASS SCHEDULE**

- A. Glass Type : Low-E-coated, Class II, tinted insulating glass.
  - 1. Overall Unit Thickness: 1-inch.
  - 2. Minimum Thickness of Each Glass Lite: 6-mm.
  - 3. Outdoor Lite: Tinted fully tempered float glass.
  - 4. Tint Color: Gray.
  - 5. Interspace Content: Argon.
  - 6. Indoor Lite: Class I, Clear fully tempered float glass.
  - 7. Low-E Coating: Pyrolytic or sputtered on second or third surface.
  - 8. Film:
    - a. Provide Frosted Film on #3 face for Window 01-27 in Health Office Restroom

- 127.
- b. Building 100: Provide Mirrored Film on #2 face for all windows facing South and East.
  - c. Building 200: Provide Mirrored Film on #2 face for all windows facing North.
- 9. Winter Nighttime U-Factor: <Insert value> maximum.
  - 10. Summer Daytime U-Factor: <Insert value> maximum.
  - 11. Visible Light Transmittance: <Insert number> percent minimum.
  - 12. Solar Heat Gain Coefficient: <Insert value> maximum.
  - 13. Safety glazing required.

### **3.10 GLAZING SEALANT SCHEDULE**

- A. Joint-Sealant Application: Non-staining silicone glazing sealant for exterior vertical non-traffic surfaces
  - 1. Uses related to Joint Substrates: M, G, A and applicable substrates indicated O.
    - a. Use O Joint Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, and wood.
  - 2. Joint Locations:
    - a. Glazing sealant
    - b. Exterior Joints for which no other sealer is indicated.
  - 3. Joint Sealant: Silicone, S, NS, Class 25, NT.
  - 4. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

**END OF SECTION**

## **SECTION 09 29 00**

### **GYPSUM BOARD**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Interior gypsum board.
  - 2. Tile backing panels.

##### **1.3 ACTION SUBMITTALS**

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

##### **1.4 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 weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

##### **1.5 FIELD CONDITIONS**

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include fuzzy or splotchy surface contamination and discoloration.

## **PART 2 PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Suspended gypsum board ceiling systems shall comply with DSA IR-25-3.13.

### **2.2 GYPSUM BOARD, GENERAL**

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

### **2.3 INTERIOR GYPSUM BOARD**

- A. Gypsum Wallboard: ASTM C 1396/C 1396M.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. National Gypsum Company.
    - b. PABCO Gypsum.
    - c. United States Gypsum Company.
    - d. Or Equal.
  - 2. Thickness: 5/8-inch.
  - 3. Long Edges: [Tapered].
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. National Gypsum Company.
    - b. PABCO Gypsum.
    - c. United States Gypsum Company.
    - d. Or Equal.
  - 2. Thickness: 5/8-inch.
  - 3. Long Edges: [Tapered].
- C. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CertainTeed Corporation.
    - b. National Gypsum Company.
    - c. United States Gypsum Company.
    - d. Or Equal.



2. Thickness: 1/4-inch.
  3. Long Edges: Tapered.
- D. Abuse-Resistant Gypsum Board: ASTM C 1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. National Gypsum Company.
    - b. PABCO Gypsum.
    - c. United States Gypsum Company.
    - d. Or Equal.
  2. Core: [5/8-inch, regular type] and [5/8-inch, Type X].
  3. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds [Level 2] requirements.
  4. Surface Indentation: ASTM C 1629/C 1629M, meets or exceeds [Level 1] requirements.
  5. Single-Drop Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds [Level 2] requirements.
  6. Long Edges: Tapered.
  7. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, Type A in maximum lengths available to minimize end-to-end butt joints with manufacturer's standard edges.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Custom Building Products.
    - b. FinPan, Inc.
    - c. United States Gypsum Company.
    - d. Or Equal.
  2. Thickness: 5/8-inch.
  3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
  2. Shapes:
    - a. Cornerbead.
    - b. Bullnose bead.
    - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - d. L-Bead: L-shaped; exposed long flange receives joint compound.
    - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    - f. Expansion (control) joint.
    - g. Curved-Edge Cornerbead: With notched or flexible flanges.

## **2.6 JOINT TREATMENT MATERIALS**

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  - 1. Interior Gypsum Board: Paper.
  - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints 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 drying-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels:
  - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.
  - 2. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

## **2.7 AUXILIARY MATERIALS**

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. 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.
- C. Isolation Strip at Exterior Walls:
  - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
- D. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
  - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hilti, Inc.

- b. Pecora Corporation.
- c. United States Gypsum Company.
- d. Or Equal.

F. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 APPLYING AND FINISHING PANELS, GENERAL**

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16-inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural

members; allow 1/4- to 3/8-inch-wide joints to install sealant.

- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

### **3.3 APPLYING INTERIOR GYPSUM BOARD**

- A. Install interior gypsum board in the following locations:
  - 1. Wallboard Type: As indicated on Drawings.
  - 2. Type X: As indicated on Drawings.
  - 3. Abuse-Resistant Type: As indicated on Drawings.
- B. Single-Layer Application:
  - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
  - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
  - 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
  - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
  - 1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers

- at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
  3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
  4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

### **3.4 APPLYING TILE BACKING PANELS**

- A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- B. Water-Resistant Backing Board: Install where indicated with 1/4-inch gap where panels abut other construction or penetrations.
- C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

### **3.5 INSTALLING TRIM ACCESSORIES**

- A. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- B. Interior Trim: Install in the following locations:
  1. Cornerbead: Use at outside corners.
  2. LC-Bead: Use at exposed panel edges.
  3. L-Bead: Use where indicated.

### **3.6 FINISHING GYPSUM BOARD**

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 2: Panels that are substrate for tile and Panels that are substrate for acoustical tile.
  - 3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

### **3.7 PROTECTION**

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include fuzzy or splotchy surface contamination and discoloration.

**END OF SECTION**

## **SECTION 09 30 13**

### **CERAMIC TILING**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Ceramic mosaic floor tile.
  - 2. Glazed wall tile.
  - 3. Waterproof membrane for thinset applications.
  - 4. Crack isolation membrane (for isolation of existing in-plane cracks).
  - 5. Metal edge strips.
- B. Related Requirements:
  - 1. Section 07 92 00 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
  - 2. Section 09 29 00 "Gypsum Board" for tile backing panels.

##### **1.3 DEFINITIONS**

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

##### **1.4 ACTION SUBMITTALS**

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

- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Verification:
  - 1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
  - 2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
  - 3. Full-size units of each type of trim and accessory for each color and finish required.
  - 4. Stone thresholds in 6-inch lengths.
  - 5. Metal edge strips in 6-inch lengths.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer.

## **1.6 QUALITY ASSURANCE**

- A. Installer Qualifications:
  - 1. Installer employs Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

## **1.8 FIELD CONDITIONS**

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.



## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
  - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
  - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
  - 2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
  - 1. Waterproof membrane.
  - 2. Crack isolation membrane.

### **2.2 PRODUCTS, GENERAL**

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
  - 1. Provide tile complying with Standard grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For Factory-mounted tile, provide back or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
  - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

## 2.3 TILE PRODUCTS

- A. Ceramic Tile Type: Factory-mounted unglazed ceramic mosaic tile.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Olean; a division of Dal-Tile Corporation.
    - b. Daltile.
    - c. Jeffrey Court Inc.
    - d. Or Equal.
  2. Product: Daltile Keystones, Mosaic Style (basis of design).
  3. Composition: Porcelain.
  4. Module Size: 2-by-2 inches.
  5. Thickness: 1/4-inch.
  6. Face: Plain with cushion edges.
  7. Surface: Smooth, matte, without abrasive admixture.
  8. Dynamic Coefficient of Friction: Not less than 0.42.
  9. Tile Color and Pattern: As selected by Architect from manufacturer's full range.
  10. Grout Color: As selected by Architect from manufacturer's full range.
- B. Ceramic Tile Type CT-01, 02, 03, 04: Glazed wall tile.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Daltile.
    - b. Jeffrey Court Inc.
    - c. Seneca Tiles, Inc.
    - d. Or Equal.
  2. Product: Daltile Color Wheel, Classic Style (basis of design).
  3. Module Size: 4-by-4 inches and 3-by-6 inches.
  4. Face Size Variation: Rectified.
  5. Thickness: 5/16-inch.
  6. Face: Plain with modified square edges or cushion edges.
  7. Finish: Gloss glaze.
  8. Tile Color: As selected by Architect from manufacturer's full range.
  9. Grout Color: As selected by Architect from manufacturer's full range.
  10. Mounting: Factory, back mounted.
  11. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
    - a. Base for Thinset Mortar Installations: Straight, module size 3-by-6 inches.
    - b. Wainscot Cap for Thinset Mortar Installations: Surface bullnose, module size 3-by-6 inches.
    - c. External Corners for Thinset Mortar Installations: Surface bullnose, same size as adjoining flat tile.
    - d. Internal Corners: Field-buttet square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.

## **2.4 WATERPROOF MEMBRANE**

- A. General: Manufacturer's standard product, selected from the following that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Custom Building Products.
    - b. Laticrete International, Inc.
    - c. Merkrete by Parex USA, Inc.
    - d. Or Equal.

## **2.5 CRACK ISOLATION MEMBRANE**

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

## **2.6 SETTING MATERIALS**

- A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. C-Cure.
    - b. Custom Building Products.
    - c. Laticrete International, Inc.
    - d. Or Equal.
  - 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
  - 3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

## **2.7 GROUT MATERIALS**

- A. High-Performance Tile Grout: ANSI A118.7.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. C-Cure.
    - b. Custom Building Products.
    - c. Laticrete International Inc.
    - d. Or Equal.
  - 2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
  - 3. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.

- B. Water-Cleanable Epoxy Grout: ANSI A118.3.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. C-Cure.
    - b. Custom Building Products.
    - c. Laticrete International Inc.
    - d. Or Equal.

## **2.8 MISCELLANEOUS MATERIALS**

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, Portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D 4397 thick.
- C. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Blanke Corporation.
    - b. Ceramic Tool Company, Inc.
    - c. Schluter Systems L.P.
    - d. Or Equal.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- E. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bonsal American, an Oldcastle company.
    - b. Custom Building Products.
    - c. TEC; H.B. Fuller Construction Products Inc.
    - d. Or Equal.
- F. Grout Sealer: Anti-microbial, sodium silicate based grout sealant:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. DuPont.
    - b. Ashland Chemical Co.
    - c. Porter Paints.
    - d. Or Equal.

## **2.9 MIXING MORTARS AND GROUT**

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
  - 2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
  - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
  - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with the District Construction Manager.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a concrete grinder, drum sander, or a polishing machine with a heavy-duty wire brush.

- C. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4-inch per foot toward drains.
- D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

### **3.3 CERAMIC TILE INSTALLATION**

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
  - 1. Back Buttering: For the following installations, follow procedures in the A108 series of tile installation standards for providing 100 percent mortar coverage:
    - a. Tile floors in wet areas, including showers, tub enclosures, laundries, and swimming pools.
    - b. Tile floors and walls composed of tiles 8-by-8 inches or larger.
    - c. Tile floors composed of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Install metal lath and scratch coat to walls to comply with ANSI A108.1A, Section 4.1.
- E. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- F. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- G. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
  - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
  - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.

3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- H. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
  1. Quarry Tile:[1/4-inch] and [3/8-inch].
  2. Glazed Wall Tile: 1/8-inch.
- I. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- J. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
  1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- K. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
  1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-Portland cement mortar (thinset).
  2. Do not extend cleavage membrane, waterproofing, or crack isolation membrane under thresholds set in latex-Portland cement mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane, waterproofing, or crack isolation membrane with elastomeric sealant.
- L. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile and where exposed edge of wall tile is visible.

### **3.4 WATERPROOFING INSTALLATION**

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

### **3.5 CRACK ISOLATION MEMBRANE INSTALLATION**

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

### **3.6 ADJUSTING AND CLEANING**

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
  - 1. Remove grout residue from tile as soon as possible.
  - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
- C. Grout Sealer: Apply grout sealer to all grout in accordance with manufacturer's recommendations.
- D. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective work.

### **3.7 PROTECTION**

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

### **3.8 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE**

- A. Interior Floor Installations, Concrete Subfloor:
  - 1. Ceramic Tile Installation, CT-05: TCNA F113; thinset mortar bonded to concrete slab-on-grade.
    - a. Thinset Mortar: Modified dry-set mortar.
    - b. Grout: grout. A118.7 and ANSI A 108.10.
- B. Interior Wall Installations, Masonry, Gypsum Board, Wood, Plaster:
  - 1. Ceramic Tile Installation CT-01, 02, 03, 04: TCNA W244C or TCNA W244F; thinset mortar on cementitious backer units or fiber-cement backer board. For use in wet or dry areas over well-braced wood or metal studs.
    - a. Ceramic Tile Type: As indicated on drawings.
    - b. Thinset Mortar: Modified dry-set Portland cement mortar.
    - c. Grout: High-performance sanded grout. A118.7, and ANSI A 108.10.



- d. Cementitious Backer Units: ANSI A118.9 or ASTM C1325 (Type B).
- e. Waterproof membrane: ANSI A118.10.
- f. Fasteners: Non-corrosive and nonoxidizing in wet areas. ASTM F2329.

**END OF SECTION**

## **SECTION 09 51 13**

### **ACOUSTICAL PANEL CEILINGS**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section includes acoustical panels and exposed suspension systems for ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
  - 1. Acoustical Panel: Set of 6-inch-square Samples of each type, color, pattern, and texture.
  - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch-long Samples of each type, finish, and color.
  - 3. Clips: Full-size seismic clips.

##### **1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For finishes to include in maintenance manuals.

##### **1.5 QUALITY ASSURANCE**

- A. Comply with the California Building Code (CBC) and the Division of State Architect (DSA) Interpretation of Regulations 25-2.13, including:
  - 1. Wires.
  - 2. Closure angles.
  - 3. Grid members.
  - 4. Compression struts.
  - 5. Anchors.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

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

## **1.7 FIELD CONDITIONS**

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to the ASCE/SEI 7.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 0-25. Comply with ASTM E 1264 for Class A materials.
  - 2. Smoke-Developed Index: 450 or less.
- C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

## **2.3 ACOUSTICAL PANELS (ACT-01)**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armstrong World Industries, Inc., Cortega.
  - 2. United States Gypsum Company, Omni Fissured.
  - 3. CertainTeed Corporation.
  - 4. Or Equal.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
  - 1. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
  - 2. Pattern: D (fissured).
- D. Color: White.
- E. Light Reflectance (LR): Not less than 0.80.
- F. Noise Reduction Coefficient (NRC): Not less than 0.55.
- G. Ceiling Attenuation Class (CAC): Not less than 35.
- H. Edge/Joint Detail: Square.
- I. Thickness: 5/8-inch.
- J. Modular Size: 24-by-24 inches and 24-by-48 inches.

## **2.4 METAL SUSPENSION SYSTEM**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armstrong World Industries, Inc.
  - 2. United States Gypsum Company.
  - 3. Chicago Metallic Corporation.
  - 4. Or Equal.
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.

- C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished 15/16-inch-wide metal caps on flanges.
  - 1. Structural Classification: Heavy-duty system.
  - 2. Face Design: Flat, flush.
  - 3. Cap Material: Steel cold-rolled sheet.
  - 4. Cap Finish: White, manufacturer's factory finish.

## **2.5 ACCESSORIES**

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  - 2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- diameter wire.
- C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Angle Hangers: Angles with legs not less than 7/8-inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch-diameter bolts.
- F. Hold-Down Clips: Manufacturer's standard hold-down.
- G. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.
- H. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.
- I. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- J. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

## **2.6 METAL EDGE MOLDINGS AND TRIM**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armstrong World Industries, Inc.
  - 2. United States Gypsum Company.
  - 3. CertainTeed Corporation.
  - 4. Or Equal.
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
  - 1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
  - 2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

## **2.7 ACOUSTICAL SEALANT**

- A. Acoustical Sealant: As specified in Section 07 92 19 "Acoustical Joint Sealants."

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

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

### **3.2 PREPARATION**

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

### 3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to the CBC, DSA, 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.
  - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three 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. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
  - 6. 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.
  - 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  - 8. Do not attach hangers to steel deck tabs.
  - 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  - 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
  - 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members 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. 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. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
  2. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
  3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

### **3.4 ERECTION TOLERANCES**

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8-inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8-inch in 12 feet, non-cumulative.

### **3.5 FIELD QUALITY CONTROL**

- A. Special Inspections: District will engage a qualified special inspector to perform tests and inspections and prepare test reports the following:
1. Compliance of seismic design.
- B. Testing Agency: District will engage a qualified testing agency to perform tests and inspections and prepare test reports.
- C. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.



### **3.6 CLEANING**

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

**END OF SECTION**

## **SECTION 09 65 13**

### **RESILIENT BASE AND ACCESSORIES**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Thermoplastic-rubber base.
- B. Related Requirements:
  - 1. Section 09 65 19 "Resilient Tile Flooring".

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

##### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

##### **1.5 FIELD CONDITIONS**

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 or more than 95 deg F, in spaces to receive resilient products during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than

95 deg F.

- C. Install resilient products after other finishing operations, including painting, have been completed.

## **1.6 QUALITY ASSURANCE**

- A. [District will have concrete floor slab moisture content tests performed by an independent laboratory. District will submit copies of the test results to the Architect, Project Inspector, and Contractor prior to the installation of resilient base and accessories. If remedial action is indicated, pe]

## **PART 2 PRODUCTS**

### **2.1 THERMOPLASTIC-RUBBER BASE <INSERT DRAWING DESIGNATION>**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Burke Mercer Flooring Products; a division of Burke Industries Inc.
  - 2. Flexco
  - 3. Roppe Corporation, USA.
  - 4. Or Equal.
- B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
  - 1. Type: BurkeBase Type TP (basis of design).
  - 2. Group: I (solid, homogeneous).
  - 3. Style and Location:
    - a. Style A, Straight: [Provide in areas with carpet].
    - b. Style B, Cove: Provide in areas with resilient flooring.
- C. Thickness: 0.125-inch.
- D. Height: 4 inches.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Preformed.
- G. Inside Corners: Job formed or Preformed.
- H. Colors: Refer to drawings.

### **2.2 INSTALLATION MATERIALS**

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
  - 1. VOC Content: Adhesives shall comply with the testing and product requirements of San Diego Air Pollution Control District Rule 67.0 "Architectural Coatings" and Rule 67.21 "Adhesive Material Application Operations."
- C. Metal Edge Strips: Extruded aluminum with mill finish, nominal 2 inches wide, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

### **3.2 PREPARATION**

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare horizontal surfaces according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient base and accessory manufacturer. Do not use solvents.
  - 3. Verify that finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
    - a. District will test concrete substrate for pH and moisture vapor emission level. Concrete must have a pH less than 10 and a moisture vapor emission level less than 3 lbs per 1,000 sf per 24 hours. If these levels are exceeded, a moisture vapor emission control system must be used before installation of resilient base and accessories.
  - 4. If moisture vapor emission control system is not required, grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.

5. If moisture vapor emission control system is required, prepare substrate in accordance with Section 09 05 61.13 "Moisture Vapor Emission Control."
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are the same temperature as the space where they are to be installed.
  1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### **3.3 RESILIENT BASE INSTALLATION**

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Exterior Corners: Install preformed exterior corners before installing straight pieces.
- H. Job-Formed Inside Corners:
  1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    - a. Miter or cope corners to minimize open joints.

### **3.4 RESILIENT ACCESSORY INSTALLATION**

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

### **3.5 CLEANING AND PROTECTION**

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum horizontal surfaces thoroughly.
  - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

**END OF SECTION**

**SECTION 09 65 19**  
**RESILIENT TILE FLOORING**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Solid vinyl floor tile (luxury vinyl tile).
- B. Related Requirements:
  - 1. Section 09 65 13 "Resilient Base and Accessories".

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency.
- B. Samples: Full-size units of each color, texture, and pattern of floor tile required.

**1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

**1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: An entity that employs installers and supervisors for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
- B. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.
- C. District will have concrete floor slab moisture content tests performed by an independent laboratory. District will submit copies of the test results to the Architect, Project Inspector, and Contractor prior to the installation of resilient tile flooring. If

remedial action is indicated, perform in accordance with Section 09 05 61.13  
"Moisture Vapor Emission Control" prior to the installation of resilient tile flooring.

## **1.6 WARRANTY**

- A. Manufacturer's Warranty: Submit manufacturer's standard warranty document.
  - 1. Warranty Period: Five (5) year limited warranty commencing on Date of Substantial Completion.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

## **1.8 FIELD CONDITIONS**

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than [65] or more than 95 deg F, in spaces to receive floor tile during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Do not install resilient sheet flooring over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by sheet flooring manufacturer.
- D. Close spaces to traffic during floor tile installation.
- E. Close spaces to traffic for 48 hours after floor tile installation.
- F. Install floor tile after other finishing operations, including painting, have been completed.



## **PART 2 PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm according to NFPA 253.
  - 2. Smoke Density: Not more than 450 according to ASTM E 662.
- B. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and CBC Section 11B-302.1.

### **2.2 SOLID VINYL FLOOR TILE <INSERT DRAWING DESIGNATION>**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Mohawk Group.
  - 2. AHF Products
  - 3. Flexco Corporation.
  - 4. Forbo Flooring Systems.
  - 5. Johnsonite; A Tarkett Company.
  - 6. Or Equal.
- B. Style: Mohawk Molveno Woods Series (basis of design).
- C. Tile Standard: ASTM F 1700.
  - 1. Class: Class III, Printed Film Vinyl Tile.
  - 2. Type: B, Embossed Surface.
- D. Thickness: 0.25-inch.
- E. Size: 7 3/4-by-59 3/4-inches.
- F. Colors and Patterns:
  - 1. "Ginger Root".
    - a. Color code: 992.
- G. Wear Surface
  - 1. 20 mil.
- H. Installation Method: Random. Minimum 6-inch end joint stagger.

## **2.3 INSTALLATION MATERIALS**

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient tile flooring manufacturer. Do not use solvents.
  - 3. Verify that finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
    - a. District will test concrete substrate for pH and moisture vapor emission level. Concrete must have a pH and a moisture vapor emission level per flooring manufacturer's recommendation. If these levels are exceeded, a moisture vapor emission control system must be used before installation of resilient tile flooring.
  - 4. If moisture vapor emission control system is not required, grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.
  - 5. If moisture vapor emission control system is required, prepare substrate in accordance with Section 09 05 61.13 "Moisture Vapor Emission Control."
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching

compound; remove bumps and ridges to produce a uniform and smooth substrate.

- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

### **3.3 FLOOR TILE INSTALLATION**

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
  - 1. Lay tiles in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. If tile color varies slightly by container, mix all tile product together prior to installing to avoid large areas of color variation. Discard broken, cracked, chipped, or deformed tiles.
  - 1. Lay tiles in pattern of colors and sizes indicated.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, accessible cabinets open to the floor, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

### **3.4 CLEANING AND PROTECTION**

- A. Comply with manufacturer's written instructions for protecting installed resilient floor tile during installation and construction. At a minimum:
  - 1. Protection from general construction: Plain, undyed kraft paper
  - 2. Protection when moving heavy loads across installed flooring on casters or dollies: ¼ inch thick minimum underlayment panels, such as plywood or hardboard.
- B. Comply with manufacturer's written instructions for cleaning resilient floor tile.
- C. Perform the following operations immediately after completing floor tile installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
- D. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- E. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
  - 1. Products without diamond-infused wear surface: Apply minimum five coat(s).
  - 2. Products with diamond-infused wear surface: Polish per manufacturer's instructions.
- F. Cover floor tile until Substantial Completion.

### **END OF SECTION**

## **SECTION 09 68 13**

### **TILE CARPETING**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section includes:
  - 1. Modular carpet tile.
  - 2. [Walk-off-mats]
- B. Related Requirements:
  - 1. Section 09 65 13 "Resilient Base and Accessories".
  - 2. Section 09 65 19 "Resilient Tile Flooring".
  - 3. Section 09 68 16 "Sheet Carpeting" for carpet roll goods.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include manufacturer's written data on physical characteristics, durability, closed cell vinyl cushion backing, and fade resistance.
  - 2. Include manufacturer's written installation recommendations for each type of substrate.
  - 3. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency.
- B. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
  - 1. Carpet Tile: Full-size Sample.
  - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.
- C. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer.
- B. Sample Warranty.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
  - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
  - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

#### **1.6 QUALITY ASSURANCE**

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level, or who can demonstrate compliance with its certification program requirements.
- B. District will have concrete floor slab moisture content tests performed by an independent laboratory. District will provide copies of the test results to the Architect, Project Inspector, and Contractor prior to the installation of tile carpeting. If remedial action is indicated, perform in accordance with Section 09 05 61.13 "Moisture Vapor Emission Control" prior to the installation of tile carpeting.
- C. Provide Manufacturer's representative to assist in project start-up and to inspect installation.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with CRI's "CRI Carpet Installation Standard."

#### **1.8 FIELD CONDITIONS**

- A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive, and have pH range recommended by carpet tile manufacturer.

## **1.9 WARRANTY**

- A. Manufacturer's standard non-prorated warranty in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
  - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
  - 2. Failures include:
    - a. More than 15 percent edge raveling, snags, zippering and runs.
    - b. Dimensional instability.
    - c. Excess static discharge. Excessive static discharge means more than 3.0 kilovolts when tested per AATCC 134 at a relative humidity of 20% and room temperature of 70% F.
    - d. Watermark on any product not 100% loop construction. Watermark means an apparent color difference between areas of the same carpet due to permanent pile reversal with random differences in pile lay direction and differences in the amount of light reflected by carpet fibers.
    - e. Resiliency Loss of Backing: More than 10-percent loss of backing resiliency.
    - f. Loss of tuft-bind strength.
    - g. Loss of face fiber.
    - h. Delamination.
  - 3. Chair pads are not required for carpet warranty coverage.
  - 4. All carpet warranties to be sole responsibility of the Manufacturer. Second source warranties or warranties that involve parties other than the Manufacturer are unacceptable.
  - 5. Warranty Period: Lifetime limited warranty.
  - 6. Warranty shall be signed by a company representative.

## **PART 2 PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and CBC Section 11B-302.2.

### **2.2 VINYL CUSHIONED TUFTED TEXTILE CARPET TILE <INSERT DRAWING DESIGNATION>**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Mohawk Industries, Inc.
  - 2. Shaw Contract
  - 3. Interface.
  - 4. Tandus; a Tarkett company.
  - 5. Or Equal.
- B. Product: Mohawk Industries Creative Culture Style (basis of design).

- C. Color: As selected by Architect from manufacturer's full range.
- D. Pattern: As selected by Architect from manufacturer's full range.
- E. Fiber Type: 100-percent branded nylon.
- F. Pile Characteristic: Textured Patterned Multi-Colored Loop.
- G. Density Factor: Minimum 5,577 oz./cu. yd.
- H. Dye Method: 100% Solution dyed.
- I. Gage: 1/12.
- J. Primary Backing: Ecoflex One.
- K. Secondary Backing: Manufacturer's standard material.
- L. Size: 12-by-36 inches.
- M. Applied Treatments:
  - 1. Soil-Resistance Treatment: 100-percent branded soil protection.
  - 2. Antimicrobial Treatment: No antimicrobials added to product ASTM E2471-05.
- N. Performance Characteristics:
  - 1. Texture Appearance Retention Rating (TARR): Severe traffic, 3.5 minimum according to ASTM D 7330.
  - 2. Critical Radiant Flux Classification: Class 1, not less than 0.45 W/sq. cm according to NFPA 253.
  - 3. Smoke Density: Not more than 450 according to ASTM E 662.
  - 4. Dry Breaking Strength: Not less than 100 lbf according to ASTM D 2646.
  - 5. Tuft Bind: Not less than 10 lbf according to ASTM D 1335.
  - 6. Delamination: No delamination according to ASTM D 3936.
  - 7. Dimensional Tolerance: Within 1/32-inch of specified size dimensions, as determined by physical measurement.
  - 8. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
  - 9. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) according to AATCC 16, Option E.
  - 10. Electrostatic Propensity: Less than 3.0 kV according to AATCC 134.
  - 11. Moisture penetration by impact at 10 psi: No penetration of backing and seam after 10,000 impacts.
  - 12. Static Coefficient of Friction: Minimum 0.60, passes ADA requirements for Accessible routes per ASTM C-1028.
  - 13. Compression Deflection: Minimum 7 lbs./sq. inch at 25%; Maximum 25 lbs./sq. inch at 25%.

## 2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.



- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile [walk-off mat] manufacturer for releasable installation.
  - 1. VOC Content: Adhesives shall comply with the testing and product requirements of San Diego Air Pollution Control District Rule 67.0 "Architectural Coatings", and Rule 67.21 "Adhesive Material Application Operations."
- C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.
- D. Rubber Edge/Transition Strips: Extruded or molded heavy-duty rubber with minimum 2-inch wide anchorage flange.
  - 1. Color: As selected by Architect from manufacturer's full range.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. General: Comply with CRI's "Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8-inch wide or wider, and protrusions more than 1/32-inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Prepare according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with

- adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by tile carpeting manufacturer. Do not use solvents.
3. Verify that finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
    - a. District will test concrete substrate for pH and moisture vapor emission level. Concrete must have a pH less than 10 and a moisture vapor emission level less than 7 lbs per 1,000 sf per 24 hours. If these levels are exceeded, a moisture vapor emission control system must be used before installation of tile carpeting.
  4. If moisture vapor emission control system is not required, grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.
  5. If moisture vapor emission control system is required, prepare substrate in accordance with Section 09 05 61.13 "Moisture Vapor Emission Control."
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

### **3.3 INSTALLATION**

- A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns indicated on Drawings.
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.

### **3.4 CLEANING AND PROTECTION**

- A. Perform the following operations immediately after installing carpet tile:
  1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
  2. Remove yarns that protrude from carpet tile surface.

3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI's "Carpet Installation Standard," Section 20, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

**END OF SECTION**

**SECTION 09 77 00**  
**SPECIAL WALL SURFACING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes.
  - 1. Self-adhered vinyl film.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- A. Sequencing Procedures:
  - 1. Complete work results of this Section after walls have been painted and are completely dry.

**1.3 ACTION SUBMITTALS**

- A. Product Data: Each type of wall covering.
- B. Shop Drawings:
  - 1. Include location schedule by room number and wall covering type.
  - 2. Show wall elevations with seaming layout.
  - 3. Show overall layout with dimension and details for penetrations and intersections with other materials or building components.
- C. Samples:
  - 1. Vinyl Film: 12 by 12 inches in size.
- D. Sample Warranty:
  - 1. Provide sample warranty meeting the criteria of this project.

**1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: Cleaning recommendations.

**1.5 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Installers: Installers shall have a minimum of 5 years' experience with installation of work similar in scope and size to this project.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
  - 1. Inspect product immediately upon delivery if shipping containers appear damaged.
    - a. Return damaged products and replace with new at no cost to the Client.
- B. Storage: Store materials indoors, protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
  - 1. Do not store roll goods on end.
  - 2. Materials should be stored above floor level, away from potential exposure to water and debris.
- C. Follow manufacturer's recommendations for delivery, storage and handling of materials.

## **1.7 FIELD CONDITIONS**

- A. Ambient Conditions: Perform Work within following limitations.
  - 1. Building enclosed and environmental systems maintaining design conditions for Owner occupancy.
  - 2. Lighting: Permanent lighting or temporary illumination providing 80 footcandles at mid-height of wall, minimum.

## **1.8 WARRANTY**

- A. Product Warranty:
  - 1. Provide warranty equal to a 3M Performance Warranty for materials specified. (basis-of-design materials).
    - a. Warranty shall be 8 years.
  - 2. General Contractor to verify print vendor/installer can meet the criteria of the warranty listed at time of construction and prior to ordering materials for installation.
    - a. General Contractor to contact Architect and Client, and hold for direction, if preferred warranty has changed or is not obtainable prior to ordering materials.

## **PART 2 PRODUCTS**

### **2.1 WALL COVERINGS**

- A. Wall Covering: Vinyl film.
  - 1. Manufacturers and Products:
    - a. 3M Envision Print Wrap: LX480mC; as basis of design.
    - b. Briteline RADV54 Series
    - c. Avery Dennison MPI1405

- d. Or approved equal.
  - 2. Material: PVC-free film.
  - 3. Finish: Luster.
  - 4. Thickness: Minimum of 2 mils.
  - 5. Application: Self-adhered, pressure-activated, w/ liner. Tack, snap-up, repositionable with air release channels.
  - 6. Size: Refer to drawings
  - 7. Pattern/Image: Refer to drawings.
- B. Overlamine: Vinyl film.
- 1. Manufacturers and Products:
    - a. 3M Envision Wrap Overlamine: 8549L; as basis of design
    - b. Briteline.
    - c. Avery.
    - d. Or approved equal.
  - 2. Material: PVC-free film.
  - 3. Finish: Luster.
  - 4. Thickness: 2 mil, minimum.

## **2.2 PERFORMANCE**

- A. Surface Burning: ASTM E84 Class A.
  - 1. Flame Spread Index: less than 25, maximum.
  - 2. Smoke Developed Index: less than 50, maximum.

## **2.3 INSTALLATION MATERIALS**

- A. Adhesive: Manufacturer-applied at factory.
- B. Substrate Primer and Sealer: Manufacturer recommended.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify substrate surfaces are ready to receive Work.
- B. Test for substrate integrity with manufacturer recommended adhesion testing method prior to material installation.
- C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at rate greater than 1/16 inch per foot.

### **3.2 PREPARATION**

- A. Follow manufacturer's recommendations for preparation and cleaning of surfaces prior to material installation.

- B. Wall substrate shall be dry and free from dirt, dust, and other contaminants. Walls shall be flat and even. Remove high spots and fill low spots with material and finish as acceptable to film manufacturer.
- C. Surface Appurtenances: Confirm locations of electrical plates, hardware, light fixture trim, escutcheons, and fittings before preparing surfaces or finishing
  - 1. Verify with Architect and Client how materials shall be applied to or around such items.

### **3.3 INSTALLATION**

- A. Follow manufacturer's recommended installation instructions for surfaces the material will be applied to.
- B. Install wall covering in sequence recommended by manufacturer.
- C. Apply material smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface. Butt edges tight.
- D. Seam materials to minimize visual disruption.
- E. Do not seam within 2 inches of internal corners nor within 6 inches of external corners.
- F. Remove excess material. Wipe clean with dry cloth.
- G. Inspection: Installed material shall be reviewed by the Architect and Client.
  - 1. Material will be adjusted or removed and reinstalled at the discretion of the Architect and Client.

### **3.4 CLEANING AND PROTECTION**

- A. Follow manufacturer's recommended cleaning instructions for material installed.
- B. Protect installed work from damage due to subsequent construction activity on the site.
  - 1. Damaged work will be replaced at no cost to the Client.

**END OF SECTION**

**SECTION 09 84 00**  
**ACOUSTIC ROOM COMPONENTS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes.
  - 1. Sound absorbing wall panels.

**1.2 ACTION SUBMITTALS**

- A. Product Data:
  - 1. Panel material and acoustical properties.
  - 2. Initial selection color Samples.
- B. Shop Drawings:
  - 1. Installation layout, direction and matching.
  - 2. Panel edge, core, dimensions.
  - 3. Penetration or device cutouts.
- C. Samples:
  - 1. Product Sample: 12 inches by 12 inches.

**1.3 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: Include fabric manufacturer recommendations for cleaning and stain removal.
- B. Warranty Documentation.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Storage and Handling Requirements:
  - 1. Open cartons to condition products to ambient temperature and humidity 24 hours minimum before installation.
  - 2. Protect products from exposure to smoke and other odor contamination.



## **1.5 FIELD CONDITIONS**

- A. Ambient Conditions: Perform work within following limitations:
  - 1. Building enclosed and environmental systems maintaining design conditions for Owner occupancy.
  - 2. Installation area permanent lighting is operational.
- B. Existing Conditions: Verify field measurements before fabrication. Show field measurements on Shop Drawings.

## **1.6 WARRANTY**

- A. Manufacturer Warranty:
  - 1. Warranty Period: 20 years.

## **PART 2 PRODUCTS**

### **2.1 SOUND ABSORBING WALL PANELS**

- A. Felt Wall Panels:
  - 1. Manufacturers and Products:
    - a. Acoufelt. Felt Wall Panels (Basis-of-Design)
      - 1) Series: "Fracture Two-Tone".
    - b. FilzFelt.
    - c. FSorb.
    - d. Kirei.
  - 2. Thickness: 1/2 inch.
  - 3. Size: See Drawings.
  - 4. Colors and Patterns: Thistle TH28.
  - 5. Mounting Method: Z-clips.
  - 6. Fire Performance: ASTM E84 Class A.

### **2.2 FABRICATION**

- A. Fabricate sizes and shapes specified or shown on Drawings, within 1/16 inch tolerance for thickness, edge straightness, overall length and width, squareness, and profiles.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that substrates are clean, dry, and ready to receive Work.
- B. Verify layout of panels will not interfere with other Work.

### **3.2 INSTALLATION**

- A. Wall Units: Attach to substrate.
- B. Lay directional pattern units with pattern running as shown on Shop Drawings.
- C. Install panels level and in plane with adjacent panels. Lay out panels per Shop Drawings.
- D. Align fabric patterns with adjacent units.
- E. Tolerances:
  - 1. Plumb, Level: 1/16 inch maximum variation.

### **3.3 CLEANING**

- A. Remove loose threads.
- B. Remove dust and soiling without damaging panel surfaces.

**END OF SECTION**

## **SECTION 09 91 13**

### **EXTERIOR PAINTING**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Work Results:
- B. Principal Products:
- C. Section includes surface preparation and the application of paint systems on exterior substrates. and the following exterior substrates:
  - 1. Steel and iron.
  - 2. Galvanized metal.
  - 3. Aluminum (not anodized or otherwise coated).
  - 4. Fiber Cement
  - 5. Portland cement plaster (stucco).
- D. Related Requirements:
  - 1. Section-05 12 00 "Structural Steel Framing" for shop priming of metal substrates.
  - 2. Section-05 50 00 "Metal Fabrications" for shop priming metal fabrications.
  - 3. Section-05 52 13 "Pipe and Tube Railings" for shop priming pipe and tube railings.
  - 4. Section-09 91 23 "Interior Painting".
  - 5. Section-09 93 00 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on exterior wood substrates.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Indicate VOC content.
- B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches square.

2. Apply coats on Samples in steps to show each coat required for system.
  3. Label each coat of each Sample.
  4. Label each Sample for location and application area.
- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

#### **1.4 QUALITY ASSURANCE**

- A. Paint Contractor shall have a minimum of five years documented experience in application of paints and coatings specified. Contractor shall maintain qualified painting crews during entire painting process.
- B. Regardless of selected paint manufacturer, Contractor is to provide exact color and gloss to match Architect's selection at no additional cost.

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

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
  1. Maintain containers in clean condition, free of foreign materials and residue.
  2. Remove rags and waste from storage areas daily.

#### **1.6 FIELD CONDITIONS**

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

#### **1.7 EXTRA MATERIALS**

- A. Do not provide any extra materials.

### **PART 2 PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Dunn-Edwards Paints (Basis of Design).
  2. Sherwin-Williams Company (The).
  3. Benjamin Moore.

## **2.2 PAINT, GENERAL**

- A. Do not provide materials that contain substances classified by the Global Hazard System as carcinogenic.
- B. Do not provide materials that contain substances listed in the Significant New Use Rule (SNUR) under Toxic Substances Control Act (TSCA).
- C. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- D. Colors: As indicated in a color schedule on Drawings.
- E. Material Quality: Provide manufacturer's best quality paint material of the various types specified that are factory formulated and recommended by manufacturer for application indicated. Use only paint material containers displaying manufacturer's product identification.
- F. Regulatory Requirements: Coatings shall comply with the testing and product requirements of San Diego Air Pollution Control District Rule 67.0 "Architectural Coatings."

## **2.3 SOURCE QUALITY CONTROL**

## **2.4 BLOCK FILLERS**

- A. Exterior Latex Block Filler:
  - 1. Dunn-Edwards Paints; SBSL00 - Smooth Bloc-Fil Select.
  - 2. PPG Paints; SPEEDHIDE® Interior/Exterior Masonry Latex Block Filler 6-15XI.
  - 3. Sherwin-Williams Company; PrepRite B25W25 Block Filler.
  - 4. Vista Paint Corporation; 40 Block Kote.
  - 5. Or Equal.

## **2.5 PRIMERS/SEALERS**

- A. Concrete and Masonry Alkali-Resistant Primer:
  - 1. Dunn-Edwards Paints; ESPR00 Eff-Stop Premium.
  - 2. Sherwin-Williams Company; Loxon Primer A24W8300.
  - 3. Or Equal.

## **2.6 METAL PRIMERS**

- A. Acrylic Ferrous Metal Primer:
  - 1. Dunn-Edwards Paints; ENPR00 EnduraPrime.

2. Sherwin-Williams Company; ProCryl B66.
  3. Or Equal.
- B. Acrylic Galvanized and Non-Ferrous Metal Waterborne Primer. (Galvanized metal shall be acid-etched with manufacturer's recommended phosphoric acid solution and rinsed before priming.):
1. Dunn-Edwards Paints; ULGM00 UltraShield Galvanized Metal Primer.
  2. Sherwin-Williams Company; ProCryl B66.
  3. Or Equal.

## **2.7 WOOD PRIMERS**

- A. Exterior Latex Wood Primer:
1. Dunn-Edwards Paints; EZPR00 EZ-Prime Premium.
  2. Sherwin-Williams Company; Prep Rite Pro Block B51W8020.
  3. Or Equal.

## **2.8 EXTERIOR LATEX PAINTS**

- A. Exterior Acrylic Latex (Semigloss):
1. Dunn-Edwards Paints; SSHL50 Sparta Shield Semi Gloss.
  2. Sherwin-Williams Company; ProIndustrial DTM Acrylic Semigloss B66-1150.
  3. Or Equal.
- B. Exterior Acrylic Latex (Gloss):
1. Dunn-Edwards Paints; SSHL60 Sparta Shield Gloss.
  2. Sherwin-Williams Company; ProIndustrial DTM Acrylic Gloss, B66-1050.
  3. Or Equal.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
  2. Masonry (Clay and CMUs): 12 percent.
  3. Wood: 15 percent.
  4. Portland Cement Plaster: 12 percent.
  5. Gypsum Board: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- D. Verify suitability of substrates, including surface conditions and compatibility, with

existing finishes and primers.

- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
  - 1. Application of coating indicates acceptance of surfaces and conditions.

### **3.2 PREPARATION**

- A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances and conditions that could impair bond of paints, including peeling paint, dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Clay Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content of surfaces or alkalinity of mortar joints to be painted exceed that permitted in manufacturer's written instructions.
- F. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- G. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
  - 1. SSPC-SP 2.
  - 2. SSPC-SP 3.
  - 3. SSPC-SP 7/NACE No. 4.
  - 4. SSPC-SP 11.
- H. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- I. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote

adhesion of subsequently applied paints.

- J. Exterior Plaster Substrates: Verify that exterior plaster has fully cured.
- K. Aluminum Substrates: Remove surface oxidation per SSPC-SP1.
- L. Exterior Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.
- M. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates
- N. Wood Substrates:
  - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
  - 2. Sand surfaces that will be exposed to view, and dust off.
  - 3. Prime edges, ends, faces, undersides, and backsides of wood.
  - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

### **3.3 APPLICATION**

- A. Apply paints according to manufacturer's written instructions.
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. Apply paints to meet manufacturer's recommended dry film thickness per coat.
  - 3. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
  - 4. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
  - 5. Paint entire exposed surface of window frames and sashes.
  - 6. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  - 7. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.



- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  - 1. Paint the following work where exposed to view:
    - a. Uninsulated metal piping.
    - b. Uninsulated plastic piping.
    - c. Pipe hangers and supports.
    - d. Metal conduit.
    - e. Plastic conduit.
    - f. Exterior condensate piping, all exposed exterior conditions whether exposed to view or not.

### **3.4 CLEANING AND PROTECTION**

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### **3.5 EXTERIOR PAINTING SCHEDULE**

- A. Concrete Substrates, Nontraffic Surfaces:
  - 1. Latex System:
    - a. Prime Coat: Concrete and Masonry Alkali-Resistant Primer.
    - b. Intermediate Coat: Exterior Acrylic Latex.
    - c. Topcoat: Exterior Acrylic Latex, semigloss.
- B. CMU Substrates:
  - 1. Latex System:
    - a. Prime Coat: Exterior Latex Block Filler.
    - b. Intermediate Coat: Exterior Acrylic Latex.
    - c. Topcoat: Exterior Acrylic Latex, semigloss.
- C. Steel and Iron Substrates:
  - 1. Acrylic System:
    - a. Prime Coat: Acrylic Ferrous Metal Primer.
    - b. Intermediate Coat: Exterior Acrylic Latex.
    - c. Topcoat: Exterior Acrylic Latex, semigloss.
- D. Galvanized-Metal Substrates:
  - 1. Latex System:

- a. Pretreatment: Non-ferrous metal pretreatment recommended by paint system manufacturer.
  - b. Prime Coat: Acrylic Galvanized and Non-Ferrous Metal Waterborne Primer.
  - c. Topcoats: Two coats of Exterior Acrylic Latex, semigloss.
- E. Aluminum Substrates:
  - 1. Latex System:
    - a. Prime Coat: Acrylic Galvanized and Non-Ferrous Metal Waterborne Primer.
    - b. Intermediate Coat: Exterior Latex, match topcoat.
    - c. Topcoat: Exterior Latex, semigloss.
- F. Wood Substrates: Glued-laminated construction.
  - 1. Latex System:
    - a. Prime Coat: Exterior Latex Wood Primer.
    - b. Intermediate Coat: Exterior Acrylic Latex.
    - c. Topcoat: Exterior Acrylic Latex, semigloss.
- G. Wood Substrates: Exposed framing.
  - 1. Latex System:
    - a. Prime Coat: Exterior Latex Wood Primer.
    - b. Intermediate Coat: Exterior Acrylic Latex.
    - c. Topcoat: Exterior Acrylic Latex, semigloss.
- H. Wood Substrates: Wood trim, Architectural woodwork, Doors, Windows, Wood board siding, Project Identification Sign, Wood-based panel products, and wood fences.
  - 1. Latex System:
    - a. Prime Coat: Exterior Latex Wood Primer.
    - b. Intermediate Coat: Exterior Acrylic Latex.
    - c. Topcoat: Exterior Acrylic Latex, semigloss.
- I. Portland Cement Plaster Substrates:
  - 1. Latex System
    - a. Prime Coat: Exterior Acrylic Latex.
    - b. Intermediate Coat: Exterior Acrylic Latex.
    - c. Topcoat: Exterior Acrylic Latex, semigloss.

**END OF SECTION**

## **SECTION 09 91 23**

### **INTERIOR PAINTING**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
  - 1. Steel and iron.
  - 2. Galvanized metal.
  - 3. Wood.
  - 4. Gypsum board.
  - 5. Spray-textured ceilings.
- B. Related Requirements:
  - 1. Section 05 12 00 "Structural Steel Framing" for shop priming structural steel.
  - 2. Section 05 50 00 "Metal Fabrications" for shop priming metal fabrications.
  - 3. Section 09 91 13 "Exterior Painting".
  - 4. Section 09 93 00 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Indicate VOC content.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches square.
  - 2. Apply coats on Samples in steps to show each coat required for system.
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to paint system and locations of application areas. Use

same designations indicated on Drawings and in schedules. Include color designations.

#### **1.4 QUALITY ASSURANCE**

- A. Paint Contractor shall have a minimum of five years documented experience in application of paints and coatings specified. Contractor shall maintain qualified painting crews during entire painting process.
- B. Regardless of selected paint manufacturer, Contractor is to provide exact color and gloss to match Architect's selection at no additional cost.

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

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

#### **1.6 FIELD CONDITIONS**

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

#### **1.7 EXTRA MATERIALS**

- A. Do not provide any extra materials.

### **PART 2 PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Dunn-Edwards Paints (Basis of Design).
  - 2. Sherwin-Williams Company (The).
  - 3. Benjamin Moore.
  - 4. Or Equal.

#### **2.2 PAINT, GENERAL**

- A. Do not provide materials that contain substances classified by the Global Hazard System as carcinogenic.

- B. Do not provide materials that contain substances listed in the Significant New Use Rule (SNUR) under Toxic Substances Control Act (TSCA)
- C. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- D. Colors: As indicated in a color schedule on the Drawings.
- E. Material Quality: Provide manufacturer's best quality paint material of the various types specified that are factory formulated and recommended by manufacturer for application indicated. Use only paint material containers displaying manufacturer's product identification.
- F. Regulatory Requirements: Coatings shall comply with the testing and product requirements of San Diego Air Pollution Control District Rule 67.0 "Architectural Coatings."

## **2.3 SOURCE QUALITY CONTROL**

## **2.4 PRIMERS/SEALERS**

- A. Interior Latex Primer/Sealer for gypsum board:
  - 1. Dunn-Edwards Paints; VNSL00 Vinylastic Select.
  - 2. Sherwin-Williams Company; ProMar 200 Zero VOC Primer, B28W2600.
  - 3. Or Equal.
- B. Interior Latex Primer/Sealer for concrete, plaster and porous surfaces:
  - 1. Dunn-Edwards Paints; UGPR00 Ultra-Grip Premium.
  - 2. Sherwin-Williams Company; Prep Rite ProBlock B51W8020.
  - 3. Or Equal.
- C. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

## **2.5 METAL PRIMERS**

- A. Acrylic Ferrous Metal Primer:
  - 1. Dunn-Edwards Paints; ENPR00 EnduraPrime.
  - 2. Sherwin-Williams Company; ProCryl B66.
  - 3. Or Equal.
- B. Acrylic Non-Ferrous Metal Primer:
  - 1. Dunn-Edwards Paints; ENPR00 EnduraPrime.
  - 2. Sherwin-Williams Company; ProCryl B66
  - 3. Or Equal.

- C. Non-Ferrous Metal Pretreatment:
  - 1. Dunn-Edwards Paints; Krud Kutter Metal Clean and Etch.
  - 2. Sherwin-Williams Company; GLL Clean 'n Etch.
  - 3. Or Equal.

## **2.6 WOOD PRIMERS**

- A. Interior Latex Wood Primer:
  - 1. Dunn-Edwards Paints; DCPR00 DecoPrime.
  - 2. Sherwin-Williams Company; Pro Block B51W8020.
  - 3. Or Equal.

## **2.7 ACRYLIC LATEX PAINTS**

- A. Interior Acrylic Latex (Eggshell):
  - 1. Dunn-Edwards Paints; SWLL30 Sparta Wall Eggshell.
  - 2. Sherwin-Williams Company; ProMar 200 Zero VOC Eggshell B20W2600.
  - 3. Or Equal.
- B. Interior Acrylic Latex (Low Sheen):
  - 1. Dunn-Edwards Paints; SWLL40 Sparta Wall Low Sheen.
  - 2. Sherwin-Williams Company; ProMar 200 Zero VOC Low Sheen, B24-2600.
  - 3. Or Equal.
- C. Interior Acrylic Latex (Semigloss):
  - 1. Dunn-Edwards Paints; SWLL50 Sparta Wall Semi Gloss.
  - 2. Sherwin-Williams Company; ProIndustrial DTM Acrylic Semigloss B66-1150.
  - 3. Or Equal.
- D. Interior Acrylic Latex (Gloss):
  - 1. Dunn-Edwards Paints; ASHL70 AristoShield.
  - 2. Sherwin-Williams Company; ProIndustrial DTM Acrylic Gloss B66-1050.
  - 3. Or Equal.
- E. Institutional Low-Odor/VOC Latex (Eggshell):
  - 1. Dunn-Edwards Paints; SWLL30 SpartaWall Eggshell.
  - 2. Sherwin-Williams Company; ProMar 200 Zero VOC Eggshell B20-2600.
  - 3. Or Equal.
- F. Institutional Low-Odor/VOC Latex (Semigloss):
  - 1. Dunn-Edwards Paints; SWLL50 SpartaWall Semi Gloss.
  - 2. Sherwin-Williams Company; ProMar 200 Zero VOC Semigloss B31-2600.
  - 3. Or Equal.

## **2.8 FLOOR COATINGS**

- A. Interior/Exterior Clear Concrete Floor Sealer (Water Based):
  - 1. Dunn-Edwards Paints; OKN-06 Okon Seal and Finish.
  - 2. Sherwin-Williams Company; H&C WL Sealer.

3. Or Equal.
- B. Latex Floor Enamel (Non-skid, low gloss):
  1. Dunn-Edwards Paints; Desert Brand CMFPS.
  2. Sherwin-Williams Company; Armorseal Tread-plex B90W111.
  3. Or Equal.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  1. Concrete: 12 percent.
  2. Fiber-Cement Board: 12 percent.
  3. Concrete Masonry: 12 percent.
  4. Wood: 15 percent.
  5. Gypsum Board: 12 percent.
  6. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- F. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- G. Proceed with coating application only after unsatisfactory conditions have been corrected.
  1. Application of coating indicates acceptance of surfaces and conditions.

### **3.2 PREPARATION**

- A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

- C. Clean substrates of substances that could impair bond of paints, including peeling paint, dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
  - 1. SSPC-SP 2.
  - 2. SSPC-SP 3.
  - 3. SSPC-SP 11.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue, per SSPC-SP1, from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Wood Substrates:
  - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
  - 2. Sand surfaces that will be exposed to view, and dust off.
  - 3. Prime edges, ends, faces, undersides, and backsides of wood.
  - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- J. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry, sanded smooth, and dust free. Sand hard, slick, previously painted surfaces and remove all sanding dust.
- K. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.
- L. Spray-Textured Ceiling Substrates: Do not begin paint application until surfaces are dry.
- M. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.



### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  - 1. Paint the following work where exposed in equipment rooms:
    - a. Uninsulated metal piping.
    - b. Uninsulated plastic piping.
    - c. Pipe hangers and supports.
    - d. Metal conduit.
    - e. Plastic conduit.
    - f. Tanks that do not have factory-applied final finishes.
    - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    - h. Mechanical equipment that is indicated to have factory-primed finish for field painting.
    - i. Electrical equipment that is indicated to have a factory-primed finish for field painting.
  - 2. Paint the following work where exposed in occupied spaces:
    - a. Equipment, including panelboards.
    - b. Uninsulated metal piping.
    - c. Uninsulated plastic piping.
    - d. Pipe hangers and supports.
    - e. Metal conduit.
    - f. Plastic conduit.
    - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

- h. Other items as directed by Architect.
  - i. <Insert mechanical items to be painted>.
- 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

### **3.4 CLEANING AND PROTECTION**

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### **3.5 INTERIOR PAINTING SCHEDULE**

- A. Concrete Substrates, Nontraffic Surfaces:
  - 1. Institutional Low-Odor/VOC Latex System:
    - a. Prime Coat: Interior Latex Primer/Sealer for concrete, plaster and porous surfaces.
    - b. Intermediate Coat: Interior Acrylic Latex.
    - c. Topcoat: Interior Acrylic Latex, semigloss.
- B. CMU Substrates:
  - 1. Institutional Low-Odor/VOC Latex System:
    - a. Block Filler/Prime Coat: Interior/Exterior Latex Block Filler.
    - b. Intermediate Coat: Interior Acrylic Latex.
    - c. Topcoat: Interior Acrylic Latex, semigloss.
- C. Steel Substrates:
  - 1. Latex System:
    - a. Prime Coat: Acrylic Ferrous Metal Primer.
    - b. Intermediate Coat: Primer, Interior Acrylic Latex.
    - c. Topcoat: Interior Acrylic Latex, semigloss.
- D. Galvanized-Metal and Non-Ferrous Substrates:
  - 1. Latex System:
    - a. Pretreatment: Non-Ferrous Metal Pretreatment.
    - b. Prime Coat: Acrylic Non-Ferrous Metal Primer.
    - c. Topcoat: Two coats of Interior Acrylic Latex, semigloss.

- E. Wood Substrates: Glued-laminated construction.
  - 1. Latex System:
    - a. Prime Coat: Interior Latex Wood Primer.
    - b. Intermediate Coat: Interior Acrylic Latex.
    - c. Topcoat: Interior Acrylic Latex, eggshell and low-sheen.
- F. Wood Substrates: Exposed framing.
  - 1. Latex System:
    - a. Prime Coat: Interior Latex Wood Primer.
    - b. Intermediate Coat: Interior Acrylic Latex.
    - c. Topcoat: Interior Acrylic Latex, low-sheen.
- G. Wood Substrates: Wood trim, Architectural woodwork, Doors, Windows, and wood board paneling.
  - 1. Latex System:
    - a. Prime Coat: Interior Latex Wood Primer.
    - b. Intermediate Coat: Interior Acrylic Latex.
    - c. Topcoat: Interior Acrylic Latex, low-sheen.
- H. Wood Substrates: Wood paneling and casework.
  - 1. Latex System:
    - a. Prime Coat: Interior Latex Wood Primer.
    - b. Intermediate Coat: Interior Acrylic Latex.
    - c. Topcoat: Interior Acrylic Latex, low-sheen.
- I. Gypsum Board Substrates:
  - 1. Institutional Low-Odor/VOC Latex System:
    - a. Prime Coat: Interior Latex Primer/Sealer for gypsum board.
    - b. Intermediate Coat: Interior Acrylic Latex.
    - c. Top Coat: Interior Acrylic Latex, eggshell and semi-gloss at restrooms and as designated on drawings.

**END OF SECTION**

**SECTION 10 11 00**  
**VISUAL DISPLAY UNITS**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Visual display board assemblies, including tackboards.
  - 2. Touchscreen-Whiteboard Frames
  - 3. Digital Viewboard Display

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include product information, construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units and accessories.
- B. Shop Drawings: For visual display units.
  - 1. Include plans, elevations, sections, details, and attachment to other work.
  - 2. Show locations of panel joints. Show locations of field-assembled joints for factory-fabricated units too large to ship in one piece.
  - 3. Include sections of typical trim members.
- C. Samples for Verification: For each type of visual display unit indicated.
  - 1. Visual Display Panel: Not less than 8-1/2-by-11 inches, with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.
  - 2. Trim: 6-inch-long sections of each trim profile.
  - 3. Display Rail: 6-inch-long section of each type.
  - 4. Accessories: Full-size Sample of each type of accessory.
- D. Product Schedule: For visual display units.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Sample Warranties: For special warranties.

## **1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For visual display units to include in maintenance manuals.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

## **1.7 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of construction contiguous with visual display units by field measurements before fabrication.
  - 1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

## **1.8 WARRANTY**

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
  - 1. Failures include:
    - a. Surfaces lose original writing and erasing qualities.
    - b. Surfaces exhibit crazing, cracking, or flaking.
  - 2. Warranty Period:
    - a. Tackboards: 5 yrs. From date of substantial completion.
- B. Touchscreen-Whiteboard Frames: Manufacturer's standard warranty.
- C. Digital Viewboard Display: Manufacturer's standard warranty.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain each type of visual display unit from single source from single manufacturer.

## **2.2 PERFORMANCE REQUIREMENTS**

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 450 or less.

## **2.3 VISUAL DISPLAY BOARD ASSEMBLY <INSERT DRAWING DESIGNATION>**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. A-1 Visual Systems.
  - 2. Claridge Products and Equipment, Inc.
  - 3. Platinum Visual Systems.
  - 4. Or Equal.
- B. Visual Display Board Assembly: Factory fabricated to the greatest extent possible.
  - 1. Assembly: tackboard.
  - 2. Corners: Square.
  - 3. Width: As indicated on Drawings.
  - 4. Height: As indicated on Drawings.
  - 5. Mounting Method: Direct to wall.
- C. Tackboard Panel: Vinyl-fabric-faced tackboard panel on core indicated.
  - 1. Fabric Wrapped Edge: Wrap edge of tackboard panel with fabric facing.
  - 2. Color and Pattern: As selected by Architect from full range of industry colors.
- D. Aluminum Frames : Fabricated from not less than 0.062-inch-thick, extruded aluminum; standard size and shape.
  - 1. Aluminum Finish: Clear anodic finish.
- E. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
- F. Display Rail: Manufacturer's standard, extruded-aluminum display rail with insert, end stops, designed to hold accessories.
  - 1. Size: 2 inches high by full length of visual display unit.
  - 2. Map Hooks: Two map hooks for every 48 inches of display rail or fraction thereof.
  - 3. Map Hooks and Clips: Two map hooks with flexible metal clips for every 48 inches of display rail or fraction thereof.
  - 4. Flag Holder: One for each room.
  - 5. Tackboard Insert Color: As selected by Architect from full range of industry colors.

## **2.4 TACKBOARD PANELS**

- A. Tackboard Panels:
  - 1. Facing: Vinyl fabric factory laminated to 1/4-inch-thick cork sheet.
  - 2. Core: Manufacturer's standard 1/4-inch-thick manufacturer's standard backing.

## **2.5 MATERIALS**

- A. Natural-Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish with surface-burning characteristics indicated.
- B. Hardboard: ANSI A135.4, tempered.
- C. Fiberboard: ASTM C 208.
- D. Particleboard: ANSI A208.1, Grade M-1.
- E. Hardwood Plywood: HPVA HP-1.
- F. Extruded Aluminum: ASTM B 221, Alloy 6063.
- G. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.
  - 1. Adhesive shall comply with the testing and product requirements of San Diego Air Pollution Control District Rule 67.0 "Architectural Coatings" and Rule 67.21 "Adhesive Material Application Operations."
- H. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Section 09 91 23 "Interior Painting" and recommended in writing by visual display unit manufacturer for intended substrate.

## **2.6 GENERAL FINISH REQUIREMENTS**

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## **2.7 ALUMINUM FINISHES**

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010-mm or thicker.

## **2.8 TOUCHSCREEN-WHITEBOARD FRAMES**

- A. Manufacturer
  - 1. BalanceBox - America
    - a. 145 Bluffs Court Canton, GA 30114
    - b. e-mail: [salesupportus@balanceboxmounts.com](mailto:salesupportus@balanceboxmounts.com)

- c. phone: +1 (678) 782-2076
- B. Products
  - 1. BalanceBox 650-II Manual Mount
    - a. Part No: 484A18 for weight range of 148-279 lbs.
  - 2. BalanceBox Winx 4b-86" touchscreen-whiteboard frame for 650-II.
    - a. Part No: 481A83 (frame for 86" screen)
    - b. Part No: 988B84 (whiteboards for Winx 4b-86 frame, 2 required per frame)
- C. Provide manufacturer recommended accessories for a complete installation.
- D. Provide product information and proposed installation locations for submittal review by Owner and Architect prior to placing order and delivery of components.

## **2.9 DIGITAL VIEWBOARD DISPLAY**

- A. Manufacturer
  - 1. ViewSonic
    - a. [www.viewsonic.com](http://www.viewsonic.com)
- B. Products
  - 1. ViewBoard 8650-5
    - a. Interactive multi-touch display unit.
    - b. 86" screen size (measured diagonally)
    - c. Weight: 147 net lbs.
    - d. All included package contents including but not limited to: power cord, remote control, USB cable, touch pens and HDMI cable.
- C. Provide product information and proposed installation locations for submittal review by Owner and Architect prior to placing order and delivery of components.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine walls and partitions for proper preparation and backing for visual display units.
- C. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.



### **3.2 PREPARATION**

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.
- D. Prime wall surfaces indicated to receive visual display units and as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.

### **3.3 INSTALLATION**

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- B. Field-Assembled Visual Display Board Assemblies: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.
  - 1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
- C. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches o.c. Secure tops and bottoms of boards to walls.
- D. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights confirmed by Owner and Architect.
- E. Touchscreen-Whiteboard Frame: Install per manufacturer's requirements.
  - 1. Provide necessary backing to support wall-mounted system at locations noted on drawings or confirmed with Owner and Architect.
  - 2. Adjust frame/panels to operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
- F. Digital Viewboard Display: Install per manufacturer's requirements.
  - 1. Provide necessary backing to support wall-mounted system at locations noted on drawings or confirmed with Owner and Architect.
  - 2. Adjust frame so display sits plumb and level on the wall.

### **3.4 CLEANING AND PROTECTION**

- A. Clean visual display units according to manufacturer's written instructions. Attach one

removable cleaning instructions label to visual display unit in each room.

- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display units after installation and cleaning.

**END OF SECTION**

## **SECTION 10 12 00**

### **DISPLAY CASES**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Display Case with Sliding Glass Doors.
- B. Related Requirements:
  - 1. Section 10 11 00 "Visual Display Units" for tackboards.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Include furnished specialties and accessories.
- B. Samples for Initial Selection: For each type of exposed finish.
  - 1. Include Samples of tackboard panels and factory-finished trim involving color finish selection.

##### **1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For display cases to include in maintenance manuals.

##### **1.5 FIELD CONDITIONS**

- A. Environmental Limitations: Do not deliver or install display cases for indoor installations until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

## **1.6 WARRANTY**

- A. Manufacturer's standard warranty.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Source Limitations: Obtain display cases from single source from single manufacturer.

### **2.2 DISPLAY CASES**

- A. Basis of Design:
  - 1. Subject to compliance with the requirements, provide:
    - a. "370 Series" recessed framed display case with sliding glass doors at manufactured by Claridge
    - b. Size: 4'-0 x 10'-0".
    - c. Depth: 16 inches.
  - 2. Prior to receipt of bids, additional Manufacturer's whose products equal or exceed the specified products may request to be included as a specified manufacture by following procedures outlined in Division 01 Section "Substitution Procedures".
- B. General: Factory-fabricated unit consisting of manufacturer's standard wall-mounted cabinet with tackboard panel on back inside surface and operable glazed doors at front.
  - 1. Frame and Cabinet Profile: Square frame section with square cabinet corners.
  - 2. Mounting: Recessed mounted.
- C. Aluminum-Framed Cabinet: Extruded aluminum; with clear anodic finish.
  - 1. Finish: Satin.
- D. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded Type 6063 aluminum; with 1-3/4 inch face.
- E. Glazed Sliding Doors: Tempered glass; set in frame matching cabinet material and finish. Equip each door with two keys.
  - 1. Glass Thickness: Not less than 3/16 inch.
  - 2. Door Frame: Extruded aluminum frame.
  - 3. Top Door Track: One piece aluminum channel with nylon guides at top of glass.
  - 4. Bottom Door Track: One piece aluminum channel with roller guide.
  - 5. Tumbler lock; sliding ratchet lock; keyed alike as applicable.
- F. Back Panel: Manufacturer's standard tackboard panel.
  - 1. Tackboard color: "Grey Mix".

## **2.3 MATERIALS**

- A. Fiberboard: ASTM C208.
- B. Linoleum: 1/4-inch- (6-mm-) thick homogeneous tackable surface material made of primary natural materials consisting of linseed oil, cork, rosin binders and dry pigments mixed and calendared onto a natural jute backing. The uni-color extends throughout the thickness of the material.
- C. Vinyl Fabric: ASTM F793/F793M, Type II, burlap weave; weighing not less than 13 oz./sq. yd. (440 g/sq. m); with flame-spread index of 25 or less when tested in accordance with ASTM E84.
- D. Extruded-Aluminum Bars and Shapes: ASTM B221 (ASTM B221M), Alloy 6063.
- E. Aluminum Tubing: ASTM B429/B429M, Alloy 6063.
- F. Clear Tempered Glass: ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.
- G. Fasteners: Provide screws, bolts, and other fastening devices made from same material as items being fastened, except provide hot-dip galvanized, stainless steel, or aluminum fasteners for exterior applications. Provide types, sizes, and lengths to suit installation conditions. Use security fasteners where exposed to view.

## **2.4 FABRICATION**

- A. Fabricate display cases to requirements indicated for dimensions, design, and thickness and finish of materials.
- B. Use metals and shapes of thickness and reinforcing required to produce flat surfaces, and to impart strength for size, design, and application indicated.
- C. Fabricate cabinets and door frames with reinforced corners, mitered to a hairline fit, with no exposed fasteners.
- D. Fabricate shelf standards plumb and at heights to align shelf brackets for level shelves.

## **2.5 GENERAL FINISH REQUIREMENTS**

- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within

the range of approved Samples and are assembled or installed to minimize contrast.

## **2.6 ALUMINUM FINISHES**

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
- B. Baked-Enamel or Powder-Coat Finish: AAMA 2603, except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine walls, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of illuminated units.
- C. Examine walls and partitions for proper backing for display cases.
- D. Examine walls and partitions for suitable framing depth if recessed units will be installed.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. General: Install units in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

### **3.3 ADJUSTING AND CLEANING**

- A. Adjust doors to operate smoothly without warp or bind and so contact points meet accurately. Lubricate operating hardware as recommended in writing by manufacturer.
- B. Touch up factory-applied finishes to restore damaged areas.

## **END OF SECTION**

**SECTION 10 14 19**  
**DIMENSIONAL LETTER SIGNAGE**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Dimensional characters.
    - a. Illuminated, fabricated channel dimensional characters.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For signs.
  - 1. Include fabrication and installation details and attachments to other work.
  - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
  - 3. Show message list, typestyles, graphic elements, and layout for each sign at least quarter size.
  - 4. Show locations of electrical service connections.
  - 5. Include diagrams for power, signal, and control wiring.
- C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
  - 1. Dimensional Characters: Full-size Sample of dimensional character.
  - 2. Full-size Samples, if approved, will be returned to Contractor for use in the Project.
- D. Product Schedule: For dimensional letter signs. Use same designations indicated on Drawings or specified.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer and manufacturer.
- B. Sample Warranty: For special warranty.

**1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For signs to include in maintenance manuals.

## **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Manufacturer of products or an entity that employs installers and supervisors who are trained and approved by manufacturer.

## **1.6 FIELD CONDITIONS**

- A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

## **1.7 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Deterioration of finishes beyond normal weathering.
    - b. Separation or delamination of sheet materials and components.
  - 2. Warranty Period: Five years from date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, to design sign structure and anchorage of rooftop dimensional character sign type(s) according to structural performance requirements.
- B. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.
  - 1. Uniform Wind Load: As indicated on Drawings.
  - 2. Other Design Load: As indicated on Drawings.
  - 3. Uniform and concentrated loads need not be assumed to act concurrently.
- C. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Design, material, font, color and mounting of all signage to comply with the latest edition of the MiraCosta College Campus-wide Signage Standards.



## 2.2 DIMENSIONAL CHARACTERS

- A. Fabricated Channel Characters: Translucent face with metal side returns, formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners; and as follows.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. APCO Graphics, Inc
    - b. ASI Sign Systems, Inc
    - c. Steel Art Company
    - d. Vomar Products, Inc.
  - 2. Illuminated Characters: Backlighting character construction with LED lighting, including transformers, insulators, and other accessories for operability, with provision for servicing and concealing connections to building electrical system. Use tight or sealed joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from character surfaces as needed to illuminate evenly.
    - a. Power: As indicated on electrical Drawings.
    - b. Weeps: Provide weep holes to drain water at lowest part of exterior characters.
  - 3. Character Material: Sheet or plate aluminum.
  - 4. Material Thickness: 0.100 inch.
  - 5. Translucent Face Sheet: Acrylic sheet with integral color as selected by Architect from manufacturer's full range.
    - a. Sheet Thickness: Manufacturer's standard thickness for size of character.
  - 6. Character Height: As indicated on Drawings.
  - 7. Character Depth: As indicated on Drawings.
  - 8. Finishes:
    - a. Integral Aluminum Finish: Clear anodized
    - b. Overcoat: Manufacturer's standard baked-on clear coating.
  - 9. Mounting: As indicated on Drawings.
  - 10. Typeface: Arial.

## 2.3 DIMENSIONAL CHARACTER MATERIALS

- A. Aluminum Castings: ASTM B26/B26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.
- B. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

## 2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
  - 1. Use concealed fasteners and anchors unless indicated to be exposed.
  - 2. For exterior exposure, furnish stainless steel devices unless otherwise indicated.
  - 3. Exposed Metal-Fastener Components, General:
    - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
    - b. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant Allen-head slots unless otherwise indicated.
  - 4. Sign Mounting Fasteners:
    - a. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

## 2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
  - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
  - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
  - 3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
  - 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
  - 5. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
  - 6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
  - 7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

- B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
  - 1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match sign-background color unless otherwise indicated.

## **2.6 GENERAL FINISH REQUIREMENTS**

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

## **2.7 ALUMINUM FINISHES**

- A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that electrical service is correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION OF DIMENSIONAL CHARACTERS**

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
  - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
  - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Mounting Methods:
  - 1. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

### **3.3 ADJUSTING AND CLEANING**

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

**END OF SECTION**

## **SECTION 10 14 23**

### **PANEL SIGNAGE**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Panel signs.
  - 2. Room-identification signs.
  - 3. Bronze Plaque.

##### **1.3 COORDINATION**

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For panel signs.
  - 1. Include fabrication and installation details and attachments to other work.
  - 2. Include plans, elevations, and large-scale sections of typical members and other components.
  - 3. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
  - 4. Show typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
  - 1. Panel Signs: Full-size Sample.
  - 2. Room-Identification Signs: Full-size Sample.
  - 3. Exposed Accessories: Full-size Sample of each accessory type.
  - 4. Cast Acrylic Sheet: Manufacturer's color charts of actual sections of material including the full range of colors available for each material required.

5. Full-size Samples, if approved, will be returned to Contractor for use in Project.

D. Sign Schedule: Use same designations specified or indicated on Drawings.

## **1.5 INFORMATIONAL SUBMITTALS**

A. Qualification Data: For Installer and manufacturer.

## **1.6 CLOSEOUT SUBMITTALS**

A. Maintenance Data: For signs to include in maintenance manuals.

## **1.7 QUALITY ASSURANCE**

A. Installer Qualifications: Manufacturer of products and An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Single Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

## **1.8 FIELD CONDITIONS**

A. Field Measurements: Verify locations of anchorage devices and electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

## **1.9 WARRANTY**

A. Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include:

- a. Deterioration of finishes beyond normal weathering.
- b. Deterioration of embedded graphic image.
- c. Separation or delamination of sheet materials and components.

2. Warranty Period: one year from date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.1 PANEL SIGNS, GENERAL**

A. Panel Signs: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

1. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16-inch measured diagonally.

- B. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished to conform with the following requirements:
  - 1. Edge Condition: Beveled.
  - 2. Corner Condition: Corners rounded to a [3/8-inch] radius.
- C. Raised Copy: Machine-cut copy characters from matte-finished opaque acrylic sheet and chemically weld onto the acrylic sheet forming sign panel face. Produce precisely formed characters with square cut edges free from burrs and cut marks.
  - 1. Panel Material: Matte-finished opaque acrylic sheet.
  - 2. Raised Copy Thickness: Not less than 1/32-inch.
  - 3. Character Type: Characters on signs shall be raised and shall be sans serif uppercase characters accompanied by California Contracted Grade 2 Braille.
  - 4. Character Height (per CBC 11B-703.2.5): Raised characters shall be a minimum of 5/8-inch and a maximum of 2-inches high, based on the height of the uppercase letter 'I'.
  - 5. Finish and Contrast (per CBC 11B-703.5.1): Contrast between character, symbols and their background must be non-glare, either light characters on dark background or dark characters on light background.
  - 6. Proportions (per CBC 11B-703.4 and CBC 11B-703.6): Characters on signs shall have an uppercase letter 'O' that is 60 percent minimum and 110 percent maximum of the height of the uppercase letter 'I'. Stroke thickness of the uppercase letter 'I' shall be 15 percent maximum of the height of the character.
  - 7. Character Spacing (per CBC 11B-703.2.7): Character spacing shall be measured between the two closest points of adjacent raised characters within a message, excluding word spaces. Where characters have rectangular cross sections, spacing between individual raised characters shall be 1/8-inch minimum and 4 times the raised character stroke width maximum. Where characters have other cross section, spacing between individual raised characters shall be 1/16-inch minimum and 4 times the raised character stroke width maximum at the base of the cross sections, and 1/8-inch minimum and 4 times the raised character stroke width maximum at the top of the cross sections. Characters shall be separated from raised borders and decorative elements 3/8-inch minimum.
  - 8. Line Spacing (per CBC 11B-703.2.8): Spacing between the baselines of separate lines of raised characters within a message shall be 135 percent minimum and 170 percent maximum of the raised character height.
  - 9. Braille Symbols (per CBC 11B-703.3 and CBC 11B-703.4): California Contracted Grade 2 Braille shall be used wherever Braille symbols are required. Dots shall have a domed or rounded shape and shall comply with CBC Table 11B-703.3.1. The indication of an uppercase letter or letters shall only be used before the first word of sentences, proper nouns and names, individual letters of the alphabet, initials, and acronyms.

## **2.2 PERFORMANCE REQUIREMENTS**

- A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

- B. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and CBC for signs.
1. Mounting Height: Tactile signs shall be located 48" minimum to the baseline of the lowest Braille cells and 60" maximum to the baseline of the highest line of raised characters above the finish floor or ground surface.
  2. Mounting Location: Tactile signs shall be located on the approach side, as one enters or exits rooms or spaces, and be reached within 0" of the required clear floor space per CBC Section and figure 11B-703.4.2 as follows:
    - a. A clear floor space of 18" x 18" minimum, centered on the tactile characters, shall be provided beyond the arc of any door swings between the closed position and 45 degree open position.
    - b. On the wall at the latch side of a single door.
    - c. On the inactive leaf of a double door with one active leaf.
    - d. On the wall at the right side of a double door with two active leaves.
    - e. On the nearest adjacent wall where there is no wall space at the latch side of a single door or no space at the right side of a double door with two active leaves.
    - f. Visual characters shall comply with CBC Section 11B-703.5 and shall be 40" minimum above finish floor or ground.
    - g. Pictograms shall comply with CBC Section 11B-703.6.
    - h. Symbol of accessibility shall comply with CBC Section 11B-703.7.
    - i. Variable Message signs shall comply with CBC Section 11B-703.8.

## 2.3 PANEL SIGNS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ASI Sign Systems, Inc.
  2. Best Sign Systems, Inc.
  3. Vomar Products, Inc.
  4. Or Equal.
- B. Panel Signs and Room Identification Signs <Insert drawing designation>: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
1. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated to acrylic backing sheet to produce composite sheet.
    - a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
    - b. Surface-Applied Flat Graphics: Applied Back painted.
  2. Sign-Panel Perimeter: Finish edges smooth.
    - a. Corner Condition in Elevation: Rounded to radius indicated.
  3. Mounting: Manufacturer's standard method for substrates indicated with .
  4. Text and Typeface: Accessible raised characters and Braille and typeface matching Architect's sample. Finish raised characters to contrast with background color, and finish Braille to match background color.
  5. Flatness Tolerance: Sign panel shall remain flat or uniformly curved under installed conditions as indicated and within a tolerance of plus or minus 1/16-inch measured diagonally from corner to corner.



- C. Bronze Plaque: Cast plaque mounted at the front of the school.
  - 1. Location: Coordinate with Owner during shop drawing review.
  - 2. Size: 24"x36".
  - 3. Mounting: Blind mount.
  - 4. Material thickness: 3/4".
  - 5. Corner treatment: Square.
  - 6. Edge treatment: Square.
  - 7. Border: single-line, 1/2" wide.
  - 8. Background texture: Brown, sand.
  - 9. Finish: Satin.
  - 10. Typestyle: To be selected by Owner during shop drawing review.
  - 11. Text: Board member names at time of ground-breaking and board member names at time of opening. Coordinate with Owner at time of shop drawing review.

## **2.4 PANEL-SIGN MATERIALS**

- A. Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet per ASTM D 4802 Type UVF (UV filtering), in sizes and thicknesses indicated, with a minimum flexural strength of 16,000 psi when tested according to ASTM D 790, with a minimum allowable continuous service temperature of 176 deg. F (80 deg. C), and of the following general types:
  - 1. Opaque Sheet: Provide colored opaque acrylic sheet in colors and finishes as selected from the manufacturer's standards.
- B. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background colors that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.
- C. Bronze Castings: Provide bronze castings, copper alloy UNS C83600, complying with the requirements of ASTM B 584.
- D. Polycarbonate Sheet: ASTM C 1349, Appendix X1, Type II (coated, mar-resistant, UV-stabilized polycarbonate), with coating on both sides.
- E. Vinyl Film: Opaque, non-reflective UV-resistant vinyl film 0.0035-inch minimum thickness, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated and suitable for exterior applications.

## **2.5 ACCESSORIES**

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs noncorrosive and compatible with each material joined, and complying with the following:
  - 1. Use concealed fasteners and anchors unless indicated to be exposed.
  - 2. For exterior exposure, furnish nonferrous-metal, or hot-dip galvanized devices unless otherwise indicated.
  - 3. Exposed Metal-Fastener Components, General:
    - a. Fabricated from same basic metal and finish of fastened metal unless

- otherwise indicated.
  - b. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish insets, as required, to be set into concrete or masonry work.
  - c. Fastener Heads: For nonstructural connections, use flathead> screws and bolts with tamper-resistant Allen-head slots unless otherwise indicated.
- 4. Sign Mounting Fasteners:
  - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
- 5. Inserts: Furnish inserts to be set by other installers into concrete or masonry work.
- B. Adhesive: Use liquid silicone adhesive as recommended by sign manufacturer.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

## 2.6 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
  - 1. Preassemble signs in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
  - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
  - 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
  - 4. Internally brace signs for stability and for securing fasteners.
  - 5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
  - 1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish, match sign-background color unless otherwise indicated.

## 2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes'.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not

acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

- D. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches as selected by the Architect from manufacturer's full range.
- E. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that anchorage devices embedded in permanent construction are correctly sized and located to accommodate signs.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
  - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
  - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
  - 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls as indicated on Drawings and according to accessibility standard.

C. Mounting Methods:

1. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
2. Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.
3. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

### **3.3 ADJUSTING AND CLEANING**

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by District.

**END OF SECTION**

## **SECTION 10 14 26**

### **POST AND PANEL/PYLON SIGNAGE**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Nonilluminated post and panel signs.
- B. Related Requirements:
  - 1. Section 01 50 00 "Temporary Facilities and Controls" for temporary Project identification signs and for temporary informational and directional signs.
  - 2. Section 03 30 00 "Cast-in-Place Concrete" for concrete foundations, concrete fill in postholes, and setting anchor bolts in concrete foundations for signs.
  - 3. Section 10 14 23 "Panel Signage" for wall-mounted sign panels.

##### **1.3 COORDINATION**

- A. Furnish templates and tolerance information for placement of sign-anchorage devices embedded in permanent construction by other installers.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For signage.
  - 1. Provide plans and elevations.
  - 2. Include fabrication and installation details and attachments to other work.
  - 3. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
  - 4. Show typestyles, graphic elements, and layout for each sign at least half size.
- C. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For manufacturer.

## **1.6 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For signs to include in maintenance manuals.

## **1.7 QUALITY ASSURANCE**

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Single Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

## **1.8 FIELD CONDITIONS**

- A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

## **1.9 WARRANTY**

- A. Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  - 1. Failures include:
    - a. Deterioration of finishes beyond normal weathering.
    - b. Deterioration of embedded graphic image.
    - c. Separation or delamination of sheet materials and components.
  - 2. Warranty Period: One year from date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.1 POST AND PANEL SIGNS, GENERAL**

- A. Panel Signs: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
  - 1. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16-inch measured diagonally.
- B. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished to conform with the following requirements:
  - 1. Edge Condition: Beveled.
  - 2. Corner Condition: Corners rounded to a 3/8-inch radius.

- C. Graphic Content and Style: Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.
  - 1. Surface-Applied, Die-Cut Vinyl Copy: Provide die-cut characters from nonreflective vinyl film with pressure-sensitive adhesive backing. Apply copy to exposed face of sign panel.

## **2.2 PERFORMANCE REQUIREMENTS**

- A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design", and CBC A117.1 for signs.

## **2.3 POST AND PANEL SIGNS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. APCO Graphics, Inc.
  - 2. ASI Sign Systems, Inc.
  - 3. Vomar Products, Inc.
  - 4. Or Equal.
- B. Post and Panel Sign <Insert drawing designation>: Sign of single-panel <Insert description> configuration; with smooth, uniform surfaces and support assembly; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
  - 1. Solid-Sheet Sign Panels: Galvanized-steel sheet with finish specified in "Sign-Panel-Face Finish and Applied Graphics" Subparagraph below and as follows:
    - a. Thickness: Manufacturer's standard for size of sign.
    - b. Surface-Applied Graphics: Applied baked enamel or powder coat.
  - 2. Posts: Steel.
    - a. Shape: Square.
    - b. Size: 3-by-3 inches.
    - c. Installation Method: Direct burial.
    - d. Finish and Color: Match sign-panel face.
  - 3. Sign-Panel-Face Finish and Applied Graphics:
    - a. Baked-Enamel or Powder-Coat Finish and Graphics: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
    - b. Photo-Image Graphics: Manufacturer's standard multicolor, halftone or dot-screen image.
    - c. Overcoat: Manufacturer's standard baked-on clear coating.
  - 4. Text and Typeface:
    - a. Character Type: Characters on signs shall be sans serif uppercase characters.
    - b. Character Height (per CBC 11B-703.2.5): Characters shall be a minimum of

- 5/8-inch and a maximum of 2-inches high, based on the height of the uppercase letter 'I'.
- c. Finish and Contrast (per CBC 11B-703.5.1): Contrast between character, symbols and their background must be non-glare, either light characters on dark background or dark characters on light background.
  - d. Proportions (per CBC 11B-703.4 and CBC 11B-703.6): Characters on signs shall have an uppercase letter 'O' that is 60 percent minimum and 110 percent maximum of the height of the uppercase letter 'I'. Stroke thickness of the uppercase letter 'I' shall be 15 percent maximum of the height of the character.
  - e. Character Spacing (per CBC 11B-703.2.7): Character spacing shall be measured between the two closest points of adjacent raised characters within a message, excluding word spaces. Where characters have rectangular cross sections, spacing between individual raised characters shall be 1/8-inch minimum and 4 times the raised character stroke width maximum. Where characters have other cross section, spacing between individual raised characters shall be 1/16-inch minimum and 4 times the raised character stroke width maximum at the base of the cross sections, and 1/8-inch minimum and 4 times the raised character stroke width maximum at the top of the cross sections. Characters shall be separated from raised borders and decorative elements 3/8-inch minimum.
  - f. Line Spacing (per CBC 11B-703.2.8): Spacing between the baselines of separate lines of characters within a message shall be 135 percent minimum and 170 percent maximum of the raised character height.

## 2.4 MATERIALS

- A. Steel Materials:
  - 1. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, G90coating, mill phosphatized either commercial or forming steel.
  - 2. Steel Sheet: electrolytic zinc-coated, ASTM A 879/A 879M, Coating Designation 08Z, with steel sheet substrate according to ASTM A 1008/A 1008M, commercial-steel, exposed.
  - 3. Hot-Rolled, Structural-Steel Shapes: ASTM A 36/A 36M or ASTM A 529/A 529M.
  - 4. Steel Members Fabricated from Plate or Bar Stock: ASTM A 529/A 529M or ASTM A 572/A 572M, 42,000-psi minimum yield strength.
  - 5. Steel Tubing or Pipe: Cold-formed steel tubing conforming with ASTM A 500/A 500M, Grade B.
  - 6. Bolts for Steel Framing: ASTM A 307 or ASTM A 325 as necessary for design loads and connection details.
  - 7. For steel exposed to view on completion, provide materials having flat, smooth surfaces without blemishes. Do not use materials whose surfaces exhibit pitting, seam marks, roller marks, rolled trade names, or roughness.
- B. Concrete for Post Holes: Mix Portland cement complying with ASTM C 150, aggregates complying with ASTM C 33, and clean water to obtain concrete with a minimum 28-day compressive strength of 2500 psi. Use at least 4 sacks of cement / cu. Yd., 1-inch maximum-size aggregate, maximum 3-inch slump, and 2 to 4 percent



entrained air.

## **2.5 ACCESSORIES**

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
  - 1. Use concealed fasteners and anchors unless indicated to be exposed.
  - 2. For exterior exposure, furnish nonferrous-metal, or hot-dip galvanized devices unless otherwise indicated.
  - 3. Exposed Metal-Fastener Components, General:
    - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
    - b. Fastener Heads: For nonstructural connections, use oval countersunk screws and bolts with tamper-resistant, Allen-head slots unless otherwise indicated.
  - 4. Inserts: Furnish inserts to be set by other installers into concrete or masonry work.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- C. Anchoring Materials:
  - 1. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
  - 2. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
    - a. Water-Resistant Product: At exterior locations, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

## **2.6 FABRICATION**

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
  - 1. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in locations concealed from view after final assembly.
  - 2. Mill joints to tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
  - 3. Comply with AWS for recommended practices in welding. Provide welds behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded joints of flux, and dress exposed and contact surfaces.
  - 4. Conceal fasteners and anchors unless indicated to be exposed; locate exposed

- fasteners where they will be inconspicuous.
5. Internally brace signs for stability, to meet performance loading without oilcanning or other surface deformation, and for securing fasteners.
- B. Post Fabrication: Fabricate posts designed to withstand wind pressure indicated for Project location and of lengths required for installation method indicated for each sign.
1. Steel Posts: Fabricate from minimum 0.120-inch-thick steel tubing unless otherwise indicated. Include post caps, fillers, spacers, junction boxes, access panels, reinforcement where required for loading conditions, and related accessories required for complete installation.
    - a. Hot-dip galvanize post assemblies after fabrication with a minimum of 2.0 oz. of zinc/sq. ft. of surface area according to ASTM A 123/A 123M.
  2. Direct Burial: Fabricate posts 36 inches longer than height of sign to permit direct burial or embedment in concrete foundations or concrete-filled postholes.

## **2.7 GENERAL FINISH REQUIREMENTS**

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

## **2.8 STEEL FINISHES**

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, and prepare for coating according to coating manufacturer's written instructions.
  1. For Baked-Enamel or Powder-Coat Finish: After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.

- B. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

## **SECTION 10 21 13.19**

### **PLASTIC TOILET COMPARTMENTS**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Solid-plastic toilet compartments configured as toilet enclosures and urinal screens.
- B. Related Requirements:
  - 1. Section 05 50 00 "Metal Fabrications" for backing to attach wall-anchored compartments screens to metal wall studs.
  - 2. Section 06 10 00 "Rough Carpentry" for blocking to attach wall-anchored compartments to wood wall studs.
  - 3. Section 10 28 00 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, and similar accessories mounted on toilet compartments.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.
- B. Shop Drawings: For toilet compartments.
  - 1. Include plans, elevations, sections, details, and attachment details.
  - 2. Show locations of cutouts for compartment-mounted toilet accessories.
  - 3. Show locations of centerlines of toilet fixtures.
  - 4. Show locations of floor drains.
  - 5. Show overhead support or bracing locations.
- C. Samples for Initial Selection: For each type of toilet compartment material indicated. Samples shall include all colors and patterns that are available from that manufacturer. Samples shall be of the same thickness and material as the compartment or screen.
  - 1. Include Samples of hardware and accessories involving material and color

selection.

- D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
  - 1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch-square Samples of same thickness and material indicated for Work.
  - 2. Each type of hardware and accessory.
- E. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For toilet compartments to include in maintenance manuals.

#### **1.5 PROJECT CONDITIONS**

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication, and indicate measurements on Shop Drawings.

### **PART 2 PRODUCTS**

#### **2.1 PERFORMANCE REQUIREMENTS**

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 75 or less.
  - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and CBC Title 24 for toilet compartments designated as accessible.
  - 1. Elements of Sanitary facilities shall be mounted at locations in compliance with CBC Sections 11B-602 through 11B-612.
  - 2. Accessible Toilet Compartments:
    - a. Wheelchair accessible compartment shall comply with CBC Section 11B-604.8.1.
    - b. Toe clearance for at least one side partitions of a wheelchair accessible compartment shall comply with CBC Sections and Figure 11B-604.8.1.4. Toe clearance shall be 9" high minimum above the finish floor and 6" deep minimum beyond the compartment side face of the partition, exclusive of partition support members. It shall be 12" high minimum above finish floor for children's use. Partition components at toe clearances shall be smooth without sharp edges or abrasive surfaces. Toe clearance at the side partition

- is not required in a compartment greater than 66" wide.
- c. Ambulatory accessible compartments shall be provided where there are six or more toilet compartments, or where the combination of urinals and water closets totals six or more fixtures. Such compartments shall be provided in the same quantity as wheelchair accessible compartments per CBC Sections 11B-213.3.1 and shall comply with CBC Section 11B-604.8.2.
- d. Door and door hardware for accessible compartments shall be self-closing and shall comply with CBC Sections 11B-404 except that if the approach is to the latch side of an ambulatory compartment door, clearance between the door side of the compartment and any obstruction shall be 44" minimum per CBC Figure 604.8.2.
- e. A door pull complying with CBC Section 11B-404.2.7 shall be placed on both sides of the accessible compartment door near the latch.
- f. Ambulatory Accessible Toilet Compartment doors shall not swing into the clear floor space or clearance required for any fixture or into the minimum required compartment area per CBC Section 11B-604.8.2.2.
- 3. Grab bars shall comply with CBC Section 11B-609 per requirements in Section 10 28 00 "Toilet, Bath and Laundry Accessories".

## **2.2 SOLID-PLASTIC TOILET COMPARTMENTS <INSERT DRAWING DESIGNATION>**

- A. Toilet-Enclosure Style: Overhead braced and floor anchored.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Scranton Products.
  - 2. Global Partitions; ASI Group.
  - 3. Bradley Corporation.
  - 4. Or Equal.
- C. Product: Hiny Hiders as manufactured by Scranton Products (Basis of Design)
- D. Entrance-Screen (Privacy Screen) Style: Overhead braced and floor anchored.
  - 1. 55" high, mounted 14" a.f.f.
- E. Urinal-Screen Style: Wall hung Floor anchored.
  - 1. 18"x42".
- F. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1-inch-thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.
  - 1. Heat-Sink Strip: Manufacturer's standard continuous, stainless-steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
  - 2. Color and Pattern: One color and pattern in each room Paisley - Orange Peel.
- G. Pilaster Shoes: Manufacturer's standard design; stainless-steel with stainless-steel fasteners.

- H. Urinal-Screen Post: Manufacturer's standard post design of 1-3/4-inch-square, aluminum tube with satin finish; with shoe, matching that on the pilaster.
- I. Brackets (Fittings):
  - 1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless-steel. Provide two continuous brackets if wainscot creates a change in wall plane. For attaching panels [screens] to walls and pilasters.

## **2.3 HARDWARE AND ACCESSORIES**

- A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.
  - 1. Hinges: Manufacturer's minimum 0.078-inch-thick stainless-steel continuous, cam type that swings to a closed position, allowing emergency access by lifting door. Mount with through-bolts.
  - 2. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless-steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
  - 3. Coat Hook: Manufacturer's heavy-duty combination cast-stainless-steel hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mount with through-bolts. Mounting height to comply with regulatory requirements for accessibility at compartments designated as accessible.
  - 4. Door Bumper: Manufacturer's heavy-duty rubber-tipped cast-stainless-steel bumper at out-swinging doors . Mount with through-bolts.
  - 5. Door Pulls: Manufacturer's heavy-duty cast-stainless-steel pull at out-swinging doors. Provide pulls on both sides of doors that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
  - 6. Continuous Brackets: Full-height, heavy duty, 1/8-inch-thick minimum, satin anodized, extruded, 6063-T5 aluminum.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with anti-grip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel.

## **2.4 MATERIALS**

- A. Aluminum Castings: ASTM B 26/B 26M.
- B. Aluminum Extrusions: ASTM B 221.

- C. Brass Castings: ASTM B 584.
- D. Brass Extrusions: ASTM B 455.
- E. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- F. Stainless-Steel Castings: ASTM A 743/A 743M.
- G. Zamac: ASTM B 86, commercial zinc-alloy die castings.

## **2.5 FABRICATION**

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories. Provide drilled holes to receive hardware, accessories, and grab bars, as indicated.
- B. Overhead-Braced Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Floor-Anchored Screens: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- D. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at bottoms of posts. Provide shoes at posts to conceal anchorage.
- E. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide, in-swinging doors for standard toilet compartments and 36-inch-wide, out-swinging doors with a minimum 32-inch-wide, clear opening for compartments designated as accessible.
- F. In addition to other latch related information in this section, provide a slot through all doors directly behind the latch to allow the opening of the doors from the outside without lifting the doors. This "hole" shall be approximately 3/8-inch x 1-inch long and centered on the latch in the closed position. Hole shall be finished with no sharp edges.
- G. Brackets: Pre-drill all holes for mounting to wall and panel/pilaster. Spacing: 9-inches on center, full length of bracket.



## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
  - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
  - 1. Maximum Clearances:
    - a. Pilasters and Panels: 1/2-inch.
    - b. Panels and Walls: 1-inch.
  - 2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets. Provide two adjacent continuous brackets if wainscot creates a change in wall plane.
    - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
    - b. Align brackets at pilasters with brackets at walls.
- B. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
- C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.
- D. Provide backing or blocking in wall for all wall attachments.

### **3.3 ADJUSTING**

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

**END OF SECTION**

## **SECTION 10 28 00**

### **TOILET, BATH, AND LAUNDRY ACCESSORIES**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Public-use washroom accessories.
  - 2. Warm-air dryers.
  - 3. Under-lavatory guards.
  - 4. Custodial accessories.
- B. Accessory Types:
  - 1. District Furnished / Contractor Installed Toilet Accessories (DFCI.)
  - 2. Contractor Furnished / Contractor Installed Toilet Accessories (CFCI.)
- C. Related Requirements:
  - 1. Section 09 30 13 "Ceramic Tiling" for ceramic toilet and bath accessories.

##### **1.3 COORDINATION**

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
  - 3. Include electrical characteristics.

- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
  - 1. Identify locations using room designations indicated.
  - 2. Identify accessories using designations indicated.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Sample Warranty: For manufacturer's special warranty.

## **1.6 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For accessories to include in maintenance manuals.

## **1.7 QUALITY ASSURANCE**

- A. Regulatory Requirements: Install toilet and bath accessories per ADA-ABA and CBC Title 24 access requirements.
  - 1. Accessible toilet accessories shall be mounted at heights and at horizontal locations according to CBC Title 24.
  - 2. Toilet paper dispensers and feminine napkin disposal units located on the grab bar side of an accessible toilet room or stall shall not project more than 3-inches from the finished wall surface nor be located closer than 1-1/2-inch clear of the tangent point of the grab bar.

## **1.8 WARRANTY**

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include visible silver spoilage defects.
  - 2. Warranty Period: 15 years from date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### **2.2 CONTRACTOR-FURNISHED CONTRACTOR-INSTALLED (CFCI) MATERIALS**

- A. All of the Public-Use Washroom Accessories, Public-Use Shower Room Accessories, Warm Air Dryers, Under-lavatory Guards, and Custodial Accessories listed below are CFCI.

## 2.3 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Toilet Tissue (Roll) Dispenser:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bobrick Washroom Equipment, Inc.
    - b. American Specialties, Inc.
    - c. Bradley Corporation.
    - d. Or Equal.
  - 2. Description: Double-roll dispenser.
  - 3. Product: Bobrick Contura Series, B-4288 (basis of design).
  - 4. Mounting: Surface mounted.
  - 5. Operation: Non-control delivery with theft-resistant spindle.
  - 6. Capacity: Designed for 4-1/2- or 5-inch- diameter tissue rolls.
  - 7. Material and Finish: Stainless-steel, No. 4 finish (satin).
- C. Combination Towel (Folded) Dispenser/Waste Receptacle:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bobrick Washroom Equipment, Inc.
    - b. American Specialties, Inc.
    - c. Bradley Corporation.
    - d. Or Equal.
  - 2. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
  - 3. Product: Bobrick Classic Series, B-3944 (basis of design).
  - 4. Mounting: Recessed.
  - 5. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.
  - 6. Minimum Waste-Receptacle Capacity: 12-gal..
  - 7. Material and Finish: Stainless-steel, No. 4 finish (satin).
  - 8. Lockset: Tumbler type for towel-dispenser compartment .
- D. Liquid-Soap Dispenser:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bobrick Washroom Equipment, Inc.
    - b. American Specialties, Inc.
    - c. Bradley Corporation.
    - d. Or Equal.
  - 2. Product: Bobrick Classic Series, B-2111 (basis of design).
  - 3. Description: Designed for dispensing soap in liquid or lotion form.
  - 4. Mounting: Vertically oriented, surface mounted.
  - 5. Capacity: 40 fl oz.
  - 6. Materials: 18-8, Type-304 stainless steel with satin finish.
  - 7. Lockset: Tumbler type.
  - 8. Refill Indicator: Window type.

- E. Grab Bar:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bobrick Washroom Equipment, Inc.
    - b. American Specialties, Inc.
    - c. Bradley Corporation.
    - d. Or Equal.
  2. Mounting: Flanges with concealed fasteners.
  3. Material: Stainless steel, 0.05-inch thick.
    - a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
  4. Outside Diameter: 1-1/2 inches.
  5. Configuration and Length: As indicated on Drawings.
- F. Vending Napkin-Tampon Dispenser:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bobrick Washroom Equipment, Inc.
    - b. American Specialties, Inc.
    - c. Bradley Corporation.
    - d. Or Equal.
  2. Type: Sanitary napkin and tampon.
  3. Product: Bobrick Contura Series, B-47064C (basis of design)
  4. Mounting: Semirecessed.
  5. Capacity: 30 tampons, 20 napkins.
  6. Operation: No coin needed.
  7. Exposed Material and Finish: Stainless-steel, No. 4 finish (satin).
  8. Lockset: Tumbler type with separate lock and key for coin box.
- G. Sanitary-Napkin Disposal Unit:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bobrick Washroom Equipment, Inc.
    - b. American Specialties, Inc.
    - c. Bradley Corporation.
    - d. Or Equal.
  2. Product: Bobrick Contura Series, B-270 (basis of design).
  3. Mounting: Surface mounted.
  4. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
  5. Receptacle: Removable.
  6. Material and Finish: Stainless-steel, No. 4 finish (satin).
- H. Seat-Cover Dispenser:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bobrick Washroom Equipment, Inc.
    - b. American Specialties, Inc.
    - c. Bradley Corporation.

- d. Or Equal.
- 2. Product: Bobrick Contura Series, B-4221 (basis of design)
- 3. Mounting: Surface mounted.
- 4. Minimum Capacity: 250 seat covers.
- 5. Exposed Material and Finish: Stainless-steel, No. 4 finish (satin).

I. Mirror Unit:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Bobrick Washroom Equipment, Inc.
  - b. American Specialties, Inc.
  - c. Bradley Corporation.
  - d. Or Equal.
- 2. Frame: Stainless-steel welded.
  - a. Corners: Welded and ground smooth.
- 3. Size: [24-inches x 36-inches at Restrooms].
- 4. Size: 24-inches x 60-inches at Lactation Room 114.
- 5. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
  - a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
  - b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

J. Coat Hook:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Bobrick Washroom Equipment, Inc.
  - b. American Specialties, Inc.
  - c. Bradley Corporation.
  - d. Or Equal.
- 2. Description: Double-prong unit.
- 3. Material and Finish: Stainless-steel, No. 4 finish (satin).

## **2.4 WARM-AIR DRYERS (STUDENT RESTROOMS ONLY)**

A. Source Limitations: Obtain warm-air dryers from single source from single manufacturer.

B. Warm-Air Dryer:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Excel Dryer
  - b. World Dryer
  - c. American Specialties, Inc.
  - d. Bobrick Washroom Equipment, Inc.
  - e. Bradley Corporation.
  - f. Or Equal.

2. Product: Excel Dryer Xlerator
3. Description: High-speed, warm-air hand dryer.
4. Mounting: Surface mounted.
  - a. Provide ADA-Compliant Recess Kit.
5. Operation: Automatic Sensor Operated.
6. Cover Material and Finish: Cast iron, with enamel finish in color selected by Architect.
7. Electrical Requirements: 110-120V, 11.3-12.2A, 1240-1450 W.

## **2.5 UNDER-LAVATORY GUARDS**

- A. Under-lavatory Guard:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Plumberex Specialty Products, Inc.
    - b. Truebro by IPS Corporation.
    - c. Or Equal.
  2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
  3. Material and Finish: Antimicrobial, molded plastic, white.

## **2.6 CUSTODIAL ACCESSORIES**

- A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.
- B. Utility Shelf:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Specialties, Inc.
    - b. Bobrick Washroom Equipment, Inc.
    - c. Bradley Corporation.
    - d. Or Equal.
  2. Product: Bobrick Surface-Mounted Utility Shelf, B-224x36 (basis of design).
  3. Description: With exposed edges turned down not less than 1/2-inch and supported by two triangular brackets welded to shelf underside.
  4. Size: 6"H x 8"D x 36"L .
  5. Material and Finish: Not less than nominal 0.05-inch-thick stainless steel, No. 4 finish (satin).

## **2.7 MATERIALS**

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0-mm-thick.

## **2.8 FABRICATION**

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to District Construction Manager.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Provide backing where basic substrate is not sufficient to support accessory without additional material.
- C. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

### **3.2 ADJUSTING AND CLEANING**

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.



- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

**END OF SECTION**

**SECTION 10 44 13**  
**FIRE PROTECTION CABINETS**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Fire-protection cabinets for the following:
    - a. Portable fire extinguishers.
- B. Related Requirements:
  - 1. Section 10 44 16 "Fire Extinguishers."

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed, semirecessed, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. [Use same designations indicated on Drawings.]

**1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

## **1.5 COORDINATION**

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

## **PART 2 PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

### **2.2 FIRE-PROTECTION CABINET <INSERT DRAWING DESIGNATION>**

- A. Cabinet Type: Suitable for fire extinguisher.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Potter Roemer LLC.
    - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
    - c. Larsens Manufacturing Company.
    - d. Or Equal.
- B. Product: Potter Roemer Loma Series, #7322-BA-RR (basis of design).
- C. Cabinet Construction: Nonrated.
- D. Cabinet Material: Cold-rolled steel sheet.
- E. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
  - 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- F. Cabinet Trim Material: Steel sheet.
- G. Door Material: Steel sheet.
- H. Door Style: Fully glazed panel with frame.
- I. Door Glazing: Full Bubble (clear).
- J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
  - 1. Provide projecting door pull and friction latch operable with 5 lbs. maximum force.
  - 2. Provide continuous hinge of same material and finish as trim, permitting door to

open 180 degrees.

K. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
  - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
    - 1) Location: Applied to cabinet door.
    - 2) Application Process: Pressure-sensitive vinyl letters.
    - 3) Lettering Color: Red.
    - 4) Orientation: Vertical.

L. Materials:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
  - a. Finish: Baked enamel or powder coat.
  - b. Color: Gloss white.
2. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3-mm-thick, Class 1 (clear).

## 2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
1. Weld joints and grind smooth.
  2. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2-inch-thick.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

## 2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not

acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine roughing-in for cabinets to verify actual locations before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

### **3.3 INSTALLATION**

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
  - 1. Mount Fire Protection Cabinets to provide a handle height for both the Fire-Protection Cabinet and Fire Extinguisher at a maximum 48" above finished floor. The bottom of surface-mounted Fire Extinguisher Cabinets shall not exceed 27" above finished floor.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
  - 1. Unless otherwise indicated, provide semi-recessed fire-protection cabinets. If wall thickness is inadequate for semi-recessed cabinets, provide surface-mounted fire-protection cabinets.
  - 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification: Apply vinyl lettering at locations indicated.

### **3.4 ADJUSTING AND CLEANING**

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding.

- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION**

**SECTION 10 44 16**  
**FIRE EXTINGUISHERS**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
  - 1. Section 10 44 13 "Fire Protection Cabinets."

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Warranty: Sample of special warranty.

**1.5 COORDINATION**

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

## **1.6 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
  - 1. Failures include:
    - a. Failure of hydrostatic test according to NFPA 10.
    - b. Faulty operation of valves or release levers.
  - 2. Warranty Period: Five years from date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

### **2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS**

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Potter Roemer LLC.
    - b. Amerex Corporation.
    - c. Ansul Incorporated; Tyco International.
    - d. Or Equal.
  - 2. Valves: Manufacturer's standard.
  - 3. Handles and Levers: Manufacturer's standard.
  - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Wet-Chemical Type <Insert drawing designation>: UL-rated 2-A:K, 1.6-gal. nominal capacity, with potassium acetate-based chemical in stainless-steel container; with pressure-indicating gage.
  - 1. Potter Roemer #3260.
  - 2. Provide at Kitchen only.
- C. Multipurpose Dry-Chemical Type in Steel Container <Insert drawing designation>: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.
  - 1. Potter Roemer #3010 (basis of design)
  - 2. Locations other than Kitchen. Coordinate all locations with Owner prior to start of construction.



## **2.3 MOUNTING BRACKETS <INSERT DRAWING DESIGNATION>**

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Potter Roemer LLC.
    - b. Amerex Corporation.
    - c. Ansul Incorporated; Tyco International.
    - d. Or Equal.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
  - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
    - a. Orientation: Vertical.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.
  - 1. Mount Fire Extinguishers to provide handle height at a maximum of 48" above finish floor, and the bottom of the fire extinguisher is at a maximum of 27" above finish floor.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

**END OF SECTION**

**SECTION 10 75 16**  
**GROUND-SET FLAGPOLES**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section includes ground-set flagpoles made from aluminum.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes for flagpoles.
- B. Shop Drawings: For flagpoles.
  - 1. Include plans, elevations, and attachment details. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
  - 2. Include section, and details of foundation system.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories,

bases, and anchorage devices, from single source from single manufacturer.

## **2.2 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Flagpole assemblies shall withstand the effects of earthquake motions determined according to the California Building Code (CBC).
- B. Structural Performance: Flagpole assemblies, including anchorages and supports, shall be in compliance with the CBC, and shall withstand design loads indicated within limits and under conditions indicated.
  - 1. Base flagpole design on nylon or cotton flags of maximum standard size suitable for use with flagpole size indicated.

## **2.3 ALUMINUM FLAGPOLES**

- A. Aluminum Flagpoles: Cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/B 241M, Alloy 6063, with a minimum wall thickness of 3/16-inch.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Flagpole.
    - b. Concord Industries, Inc.
    - c. U.S. Flag & Flagpole Supply, LP.
    - d. Or Equal.
- B. Exposed Height: 35 feet.
- C. Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:
  - 1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
  - 2. Provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.
- D. Sleeve for Aluminum Flagpole: Fiberglass or PVC pipe foundation sleeve, made to fit flagpole, for casting into concrete foundation.
  - 1. Flashing Collar: Same material and finish as flagpole.

## **2.4 FITTINGS**

- A. Finial Ball: Flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
  - 1. 20-oz. copper with 23-karat, gold-leaf finish.
  - 2. 6" diameter ball
- B. External Halyard: Ball-bearing, non-fouling, revolving truck assembly of cast metal with continuous 5/16-inch-diameter, braided polypropylene halyard and 9-inch cast-metal cleats with fasteners. Finish exposed metal surfaces to match flagpole.
  - 1. Halyards and Cleats: One halyard and one cleat at each flagpole.
  - 2. Cleat Covers: Cast metal, finished to match flagpole, secured with cylinder locks.

3. Halyard Covers: 2-inch channel, 60 inches long, finished to match flagpole.
4. Halyard Flag Snaps: Chromium-plated bronze. Furnish two per halyard.
  - a. Provide with neoprene or vinyl covers.

## **2.5 MISCELLANEOUS MATERIALS**

- A. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.
- B. Sand: ASTM C 33/C 33M, fine aggregate.
- C. Elastomeric Joint Sealant: Single-component nonsag urethane joint sealant complying with requirements in Section 07 92 00 "Joint Sealants."
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

## **2.6 ALUMINUM FINISHES**

- A. Natural Satin Finish: AA-M32, fine, directional, medium satin polish; buff complying with AA-M20; seal aluminum surfaces with clear, hard-coat wax.
- B. Clear Anodic Finish: AAMA 611, AA-M12C22A41.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.
- B. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.
- C. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.
- D. Sleeves: Locate and secure sleeves in forms by bracing to reinforcement and forms.
- E. Place concrete, as specified in Section 03 30 00 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.
- F. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to

perimeter of concrete base.

### **3.2 FLAGPOLE INSTALLATION**

- A. General: Install flagpoles where indicated and according to Shop Drawings and manufacturer's written instructions.
- B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

**END OF SECTION**

**SECTION 11 40 00**  
**FOODSERVICE EQUIPMENT**

**PART I GENERAL**

**1.1 RELATED DOCUMENTS**

- A. General provisions of the contract, including General Conditions, Supplementary Conditions and General Documents, other Division I specification Documents and other Division I specification sections apply under this section.

**1.2 SCOPE OF WORK**

- A. Furnish all labor, materials and services necessary for the installation of food service equipment in strict accordance with the Contract Documents and local codes including that which is reasonably inferred. No extra charge will be allowed for that which the Kitchen Equipment Contractor should have been familiar.
- B. Supervise and provide required instructions for work to be performed by other contractors in connection with requirements for all equipment under this section.

**1.3 RELATED WORK SPECIFIED ELSEWHERE**

- A. LEED-NC Requirements: Division 1.
- B. Floors and setting beds, quarry tile and base, masonry pads, walls and finishes, ceilings and related building work: Divisions 3 through 9.
- C. Sub-floor, water proofing, floor depressions, wearing floor and coved base, and related building work for cold storage rooms: Divisions 3 through 9.
- D. Wire cloth, concrete setting bed, floor tile, grout and tile wall base with wire cloth and epoxy grout at depressed cold storage rooms: Divisions 3 through 9.
- E. Wall backing to support all wall mounted equipment: Division 5.
- F. All sealants: Division 7.
- G. All hood or ventilator duct work upstream from the connection position: Division 23.
- H. All water, waste, indirect waste piping from sinks and ventilators, steam and gas services to the equipment including all shut-off valves, plumbing trim, traps, etc., and final connections to the equipment except as specified herein: Division 22 and 23.

FOODSERVICE EQUIPMENT  
11 40 00 - 1

- I. All floor sinks and floor drains: Division 22.
- J. Piping sleeves for refrigeration and drain lines through building floors: Division 22 and 23.
- K. Final connection of the re-circulating and city water to refrigeration rack: Division 22.
- L. All electric services and components including wiring to and final connections to all equipment except as specified herein: Division 26.
- M. Furnishing and installation of conduit at cold storage rooms in cooperation with the Kitchen Equipment Contractor: Division 26.
- N. Furnishing and installation of main power lines to refrigeration systems control panel and wiring for control/defrost heaters between panel and coils in accordance with factory supplied wiring diagrams and local codes: Division 26.
- O. Installation of light fixtures furnished loose at cold storage rooms: Division 26.
- P. Connection of cold storage room temperature alarm system to the building security system: Division 26.
- Q. Grounding type receptacles for all wall mounted outlets to be used for plug-in equipment: Division 26.

#### **1.4 OWNER/PURVEYOR FURNISHED EQUIPMENT**

- A. Obtain and coordinate manufacturer and model number not less than 60 days before equipment is required.
- B. Obtain and coordinate utility requirements.

#### **1.5 EXISTING EQUIPMENT**

- A. Items of equipment scheduled and specified "Existing" or "By Owner" shall be removed from their present location and reinstalled as shown on the drawings and hereinafter specified.
- B. Verify location of existing equipment with Owner.
- C. Existing equipment utility connections shall be disconnected by others.
- D. All equipment shall be thoroughly cleaned and all broken or defective components replaced.

#### **1.6 REGULATIONS**

FOODSERVICE EQUIPMENT

11 40 00 - 2

- A. All work and materials shall be in accordance with the latest rules and/or regulations of agencies/authorities having jurisdiction.
- B. All regulations, including building codes, and other codes applying to this jurisdiction should be followed. In addition all equipment shall comply with the following:
  - 1. Local Health Code
  - 2. National Fire Protection Association, Kitchen Ventilators (NFPA-96).
  - 3. National Electric Manufacturer's Association (N.E.M.A.).
  - 4. Underwriters Laboratories Inc., (U.L.), must bear label.
  - 5. National Electric Code, (N.E.C.).
  - 6. National Sanitation Foundation, (N.S.F.), including NSF-7, must bear label.
  - 7. American Society of Mechanical Engineers must carry the (A.S.M.E.) stamp.
  - 8. American Gas Association (A.G.A.).
  - 9. Occupational Safety and Health Act (O.S.H.A.) Standards.
  - 10. Hazard Analysis Critical Control Path (H.A.C.C.P.) Standards.
  - 11. America Disability Act (A.D.A.) Standards.
- C. The Contract Documents shall govern wherever they require larger sizes or higher standards than are required by regulations.
- D. The regulations shall govern whenever the Contract Documents require something which will violate the regulations.
- E. When seismic regulations are applicable, all equipment shall be fabricated and installed in accordance with those regulations. All seismic requirements shall be shown on all submittals. Submit requested information to the agencies and authorities having jurisdiction.
- F. No extra charge will be paid for furnishing items required by the regulations, but not specified and/or shown on the drawings.
- G. Rulings and interpretations of the enforcing agencies shall be considered a part of the regulations.

## **1.7 ALTERNATES AND SUBSTITUTIONS**

- A. The materials or products specified herein by trade names, manufacturer's name or catalog number shall be provided as specified. Substitutions will not be permitted unless approved by owner's representative in writing no later than 10 days prior to bidding. This stipulation applies to all equipment & materials. All substitutions or alternates will be expected to perform in all respects as well as the original specification.
- B. Refer to Foodservice Equipment Bidders Guidelines.

## **1.8 REVIEW OF CONTRACT DOCUMENTS**

FOODSERVICE EQUIPMENT

11 40 00 - 3



- A. Unless expressly stipulated, and in a timely manner, no additional allowances will be made for Contractors or Manufacturers for errors, omissions or ambiguities not reported at time of bidding.
- B. Carefully review and compare the Contract Documents and at once report to Owner and/or Designer any errors, ambiguities, inconsistencies or omissions. Unless expressly stipulated, and in a timely manner, Kitchen Equipment Contractor shall be liable to Owner or Designer for any damage resulting from such errors, inconsistencies or omissions in the Contract Documents. Work shall not be done without approved Drawings, Specifications and/or Modifications and without receiving prior written authorization from Owner or Designer.

## **1.9 WARRANTY**

- A. All equipment, fixtures and materials furnished and installed shall be guaranteed against defect in workmanship and material. All repairs and replacements which may have become apparent and necessary by reasons of such defects, during the first year after final completion and acceptance of equipment installation, shall be made without cost and expense to the Owner. All such repairs and replacements shall be made at a time and during hours satisfactory to the Owner.
- B. For all commercially manufactured equipment that has refrigeration systems and semi-hermetic compressors, furnish an additional four (4) year warranty on all compressors.
- C. Warranty period shall commence with the date of final acceptance of installation by Owner.
- D. Components of equipment subject to replacement prior to one year's use and those items which may fail due to improper or inadequate periodic maintenance by the Owner/Operator are not intended to be included within the scope of warranty.
- E. Provide all labor, material, refrigerant, and incidental expenses to maintain the temperatures specified on all refrigeration systems. Systems to be kept in first class working condition for a period of one (1) year from date of acceptance by Owner, or the date systems are put into operation, whichever occurs first, without additional cost to the Owner.

## **1.10 SUBMITTALS**

- A. Use of Consultants Drawings

Consultant Drawings are not intended for construction purposes, but are information intended only for use by the Architect and Engineers as an aid in the design of the building and utility distribution systems and for bidding equipment purchase. Consultant drawings in electronic format will not be issued by the Architect or Owner to third parties, including equipment suppliers, without express written consent of the Consultant.

FOODSERVICE EQUIPMENT

11 40 00 - 4

Consultant base Equipment Plans and Equipment Elevation Sheets will be provided to contracted equipment supplier in PDF electronic format on request without charge. Utility rough-in/connection schedules and plans will be provided in electronic format on payment by the KEC to Consultant of a nominal fee of \$250 per drawing sheet for third party formatting. Regardless of fees charged the transfer of drawings is not to be considered a sale and the Consultant makes no warranties, express or implied, of Merchantability or of fitness for a particular purpose.

Regardless of drawing formats provided it will remain the responsibility of equipment supplier to develop submittals in accordance with the Specific Conditions and assume all required responsibilities there to. The consultant is not to be liable for errors or omissions by the KEC's use of electronic data provided by the Consultant or the development of data used in the submittal approval process.

B. Product Data

1. After award of contract and before proceeding with the purchase of manufactured equipment, submit four (4) bound sets of specification sheets consisting of:  
Hard Cover  
Title Sheet

Index all items with columns for: Item number, quantity, description and status (fabricated, manufactured, by Owner/Operator, by General Contractor, etc.)

A typewritten lead sheet for each manufactured equipment item showing: Item number, quantity, description; manufacturer's name, address and telephone; model number; optional finishes, equipment, accessories and modifications; utilities required and special notes.

Manufacturer's specification sheets and/or drawings.

C. Drawing Submittals

1. All drawing submittals to be provided in PDF format.

D. Rough-In Drawings.

1. Drawings shall be dimensioned, showing ventilation requirements, floor and wall sleeves, plumbing, gas, steam, and electrical connections, including those items supplied by the Owner. Provide concrete pad dimensions, depressions and special conditions as required for equipment. Elevations and sections of special work shall be prepared for use of the respective trades. Kitchen Equipment Contractor shall be responsible for the accuracy of all information on his drawings.
2. The following shall each be drawn on separate sheets and/or plans: Plumbing; Electrical; Building Works & Ventilation; Refrigeration and Beverage Systems.

FOODSERVICE EQUIPMENT

11 40 00 - 5

3. Utilities shall be stubbed out of walls wherever possible.
4. Verify mechanical, electrical, and ventilation rough-in and sleeve/conduit locations before floor slabs are poured.
5. In the event rough-in has been accomplished before the award of the contract, check existing facility and furnish all equipment to suit building conditions and utilities. No extra charges shall be allowed for utility changes to fit equipment during installation and connection.

E. Wall Backing Drawings

1. Prepare and submit as wall backing drawings. The drawings shall show the location and size of all wall backing required. The drawings shall be submitted for checking and to the General Contractor in time for the wall backing to be installed prior to closing of the walls.

F. Shop Drawings

1. Prepare and submit shop drawings for all special fabricated items of work included in this contract. The detail drawings shall be submitted at minimum of  $\frac{3}{4}$ " (1:20) scale for elevations and 1-1/2" (1:10) scale for sections. Drawings shall show all dimensions, all details of construction, installation and relation to adjoining and related work. Drawings shall show all reinforcements, anchorage and other related work required for the complete installation of all fixtures.

G. Record Drawings

1. At the conclusion of the project and prior to final payment provide updated record Drawings incorporating all changes that occurred during construction in the form of CAD disks and one (1) set of vellums.

H. Checking

1. Checking product data, rough-in drawings, wall backing drawings, shop drawings, and refrigeration drawings by Designer is for design concept only, and does not relieve the Kitchen Equipment Contractor of responsibility for compliance with Contract Documents, verification of utilities with equipment requirements for conformity and location, verification of all dimensions of equipment and building conditions or reasonable adjustments due to deviations.
2. Drawings shall be prepared on the Kitchen Equipment Contractor's sheets and by his employees. Drawings and any part thereof created by photograph, paste-up, or other methods using Designers drawings and/or details will be returned for re-submittal.
3. Submittals and checking shall be accomplished before ordering equipment or starting fabrication.

I. Requests for Information (RFI's).

FOODSERVICE EQUIPMENT

11 40 00 - 6

All RFI's to be submitted per General Conditions or otherwise by e-mail directly to the project manager.

#### **1.11 PARTS AND SERVICE MANUALS**

- A. Furnish three (3) bound sets of parts and service manuals.
  - 1. The manuals shall include a source directory for parts and service for all items.
  - 2. The manuals shall be submitted in time to allow review and transmittal to the Owner/Operator prior to start-up and demonstration of the equipment. Manuals must be submitted before the Owner will issue final acceptance of the installation.

#### **1.12 VERIFICATION AND COORDINATION OF PROJECT/DATA**

- A. Range Lines

All front manifold range lines shall be assembled and aligned at the factory before shipment, including back guards, high shelves and salamanders.

- B. Pans and Inserts

Verify sizes with Owner on the following items before ordering or fabrication:

- 1. Steam Pans.
- 2. Sheet Pans.
- 3. Trays.
- 4. Glass and Cup Racks.

- C. Quietness of Operation

Quietness of operation of all food service and refrigeration equipment is a requirement. Remove or repair any equipment producing abnormal and objectionable noises.

- D. Delivery and Entry

Verify all conditions at the building, particularly door openings and passageways for large equipment. Coordinate with the General Contractor access to insure delivery of equipment to the required areas. Coordination shall include, but not be limited to, early delivery, hoisting, window removal and/or delay of wall construction. All special equipment, handling charges, window removal, etc. shall be paid for by the Kitchen Equipment Contractor.

- E. Connection Terminals

All equipment will be complete with standard connections as they relate to their Country of Origin. It shall be the responsibility of the Kitchen Equipment Contractor to

FOODSERVICE EQUIPMENT

11 40 00 - 7

provide any and all required adaptors to assure the proper connection to the conditions at the jobsite.

F. Site Verification

Notify Designer, Owner and the General Contractor in writing if, in the Kitchen Equipment Contractor's opinion, the jobsite is not adequate to insure proper installation of the equipment. Notification shall be in writing with sufficient time to effect corrective measures to meet the installation schedule.

## **PART 2 PRODUCTS**

### **2.1 COMMERCIALLY MANUFACTURED EQUIPMENT**

- A. All items of standard equipment shall be the latest model at time of delivery.
- B. Follow manufacturer's directions used to fulfill this contract which cover points not necessarily shown on the drawings or specifications.
- C. All doors shall be hinged as shown on plans.

### **2.2 PLUMBING WORK**

- A. Provide suitable pipe slots, chases and/or do all drilling, punching and cutting of equipment required to provide access for Division 22 connections and/or runs. Such work performed at the job site shall be of the same quality as similar work in the shop.
- B. To ensure proper clearance for cleaning, all horizontal piping lines shall be run at the highest possible elevation through equipment and not less than 6" (150 mm) above floor, wherever possible.
- C. Indirect waste piping (except from sinks and ventilators) shall be installed in accordance with the local codes. Piping shall run as described hereinafter, and shall discharge into floor sinks. Extend piping to a point of at least 2" (50 mm) above rim of floor sink and cut bottom on 45° angle. All indirect waste piping shall be installed and routed in a manner to insure proper drainage and shall conform with shelves, spaces, equipment or building conditions. Indirect waste piping to be secured to fixture.
  - 1. Indirect waste piping from ice bins, ice pans or similar items shall be insulated to prevent condensation.
- D. Water inlets shall be located above the positive water level to prevent siphoning of liquids into the water system. Wherever conditions shall require a submerged inlet. Provide a suitable type of check valve and vacuum breaker.
- E. Where exposed, piping and fittings shall be chrome plated.

- F. Faucets shall be furnished on all sinks, bain maries, water stations and other fixtures as detailed or specified and shall be supplied with non-splash aerator, water saving devices where required by local codes.

- G. **DRAINS AND WASTES**

- 1. Furnish all necessary drains and wastes with the equipment.

## **2.3 VENTILATION WORK**

- A. Provide all labor, material and installation services to install all hoods including trim per Consultants design intent; verify sizes and locations of duct connections; and provide assistance in duct layout as required.

## **2.4 ELECTRICAL WORK**

- A. Insure that all equipment furnished under this contract shall be so wired, wound or constructed as to conform with the characteristics of electrical and other services at the premises.
- B. Appliances shall be new, of manufacturer's current production and furnished complete with motors drive mechanism, starters and controllers, including master switches, timers, cut-outs, reversing mechanism and other electrical equipment if and as applicable. Wiring and connection diagrams shall be furnished with electrically operated machines and for all fabricated equipment.
- C. All conduit wiring shall be run concealed wherever possible. Conduit shall be continuous from outlet to outlet and from outlet to load center circuit or pull boxes and shall center and be secured in such a manner that each system shall be electrically continuous throughout. All conduits shall be thoroughly and substantially supported by accepted industry practices.
- D. Supply on each motor driven appliance or electrical heating unit, a suitable control switch or starter of proper type wherever such equipment is not so built.
- E. All plug-in equipment shall have plugs and cords furnished and installed. Coordinate work with Division 26 so that the receptacles provided will match the specific plugs installed as part of the plug-in equipment. Any changes on cords and plugs required in the field due to lack of coordination between Division 26 and Kitchen Equipment Contractor shall be the latter's responsibility.
- F. All electrically heated, fabricated equipment shall be internally wired to a thermostatic control and an "on/off" red light indicator, both to be mounted in a terminal box with a removable access panel and located outside the heating area. Wiring to be nickel-plated copper, properly insulated.

- G. Provide all incandescent bulbs and fluorescent tubes required for equipment under this section.

## **2.5 FABRICATED EQUIPMENT**

### **A. Special Fabricated Equipment**

All specially fabricated equipment must be by one manufacturer acceptable to Designer and the Owner.

### **B. Workmanship**

All work must be done in an approved workmanlike manner to the complete satisfaction of Designer and the Owner.

### **C. Stainless Steel**

All stainless steel shall be the U.S. standard gauge, 18-8, Type 304, finish as noted in Paragraph 2.5N.

### **D. Galvanized Steel**

All galvanized steel shall be electro-galvanized.

### **E. Welding and Soldering**

1. All seams and joints shall be shop welded or soldered as the nature of the material may require. Welds to be ground smooth and polished to match original finish.
2. Framework of galvanized steel shall be welded construction. Where galvanizing has been burned off, the weld shall be touched up with high-grade aluminum paint.

### **F. Sound Deadening**

The underside of all metal to tables, counters, drainboards, sinks and dish tables shall have a hard drying mastic 1/16" (2 mm) minimum thickness. Exposed mastic will not be acceptable.

### **G. Metal Top Construction**

1. All seams and joints shall be one-piece welded construction, reinforced on the underside with galvanized steel reinforcing welded in place so tops can support heavy weight without deflection. Cross braces to be not more than 30" (760 mm) on center.

2. Field joints in stainless steel tops; where required due to limitation of sheet sizes, equipment sizes or installation requirements shall be welded, ground smooth and polished to blend with adjacent surfaces.
3. If inverted hat sections are used in lieu of channels, close ends. All exposed sides, ends, etc. shall be stainless steel #4 finish.

H. Fasteners

1. Exposed bolt heads will not be permitted on fixtures.
2. Butt joints made by riveting straps under seams and then filled with solder will not be accepted.
3. Rivets of any kind, including pop-rivets, will not be accepted.
4. Exposed screw heads, when necessary, shall be one of the same material as the pieces joined and countersunk flush.

I. Rolled Edges

Rolls shall be as detailed with corners bull nosed, welded, ground and polished.

J. Corners

Dish tables, drainboards, splash backs and turned up edges shall have ½" (15 mm) or larger radius bends in all horizontal and vertical corners, coved at intersections unless specified otherwise.

K. Enclosed Cabinet Bases

Bases shall be made of 18 gauge stainless steel sheets reinforced by forming the metal. Sides and partitions shall terminate at front in a 2" (50 mm) wide fully enclosed mullion and welded at intersections. Shelves are to be removable where detailed. Exposed ends, partitions and shelves are stainless steel.

L. Legs and Cross Rails

1. Equipment legs and cross rails shall be 1-5/8" (40 mm) 16 gauge stainless steel tubing unless otherwise noted. All welds at cross rails shall be continuous and ground smooth. Tack welds are not acceptable. Tops of legs to be fitted with Component Hardware A20-0406 or A20-0206 leg sockets or approved equal. Gussets are to be welded to underside of sinks and bracing.
2. Bottom of legs to be fitted with Component Hardware A10-0852 adjustable stainless steel foot or approved equal. Foot plug to be welded, ground and polished. When flanged feet are specified, use Component Hardware 010-0854 adjustable stainless steel foot or approved equal.
3. Enclosed cabinet bases mounted on 6" (150 mm) high legs are to be equipped with Component Hardware 8048 Series adjustable stainless steel counter legs or approved equal, with mounting plate as required.



M. Metal Gauge

Unless otherwise noted in itemized specifications or details, all gauges to be manufactured to the following minimum thickness:

<u>Stainless Steel USS Gauge</u>	<u>Decimal Thickness</u>	<u>Millimeter Thickness</u>
12	.1094	2.78
14	.0781	1.98
16	.0625	1.59
18	.0500	1.27
20	.0375	0.95

N. Materials

All fabricated items to be provided in gauge, metal type and finished per the following table:

<u>Description</u>	<u>Gauge</u>	<u>Metal</u>	<u>Finish No.</u>
<u>Dish table, Table and Countertops</u>	16	S.S.	4
<u>Hat Sections/Channel:</u>			
Unexposed	14	Galvanized	---
Exposed	16	S.S.	4
<u>Counter Body:</u>			
Framework	14	Galvanized	---
Aprons, Partitions, Backs and Ends:			
(Exposed)	18	S.S.	4
(Unexposed)	18	Galvanized	---
Shelves	16	S.S.	4
<u>Doors</u>			
Outside faces	18	S.S.	4
Inside faces	20	S.S.	2B
<u>Drawer Pans</u>			
General	20	S.S.	2B
Refrigerated	20	S.S.	2B
<u>Shelf</u>			
Wall Mounted	16	S.S.	4
Fixture Mounted	16	S.S.	4
Table	16	S.S.	4
Refrigerator		S.S. Wire	4
<u>Shelf Bracket (Exposed)</u>	16	S.S.	4
<u>Wall Flashing</u>	20	S.S.	4
<u>Equipment Legs &amp; Cross</u>	16	1-5/8" diameter S.S.	4

FOODSERVICE EQUIPMENT  
11 40 00 - 12

	<u>Description</u>	<u>Gauge</u>	<u>Metal</u>	<u>Finish No.</u>
	<u>Rails</u>		tubing	
O.	Closure			
	Backs of all fixtures, splash back, shelves, etc., shall be closed.			
P.	Casters			
	Casters shall be heavy duty, non-marking, ball bearing NSF approved type with greaseproof neoprene or polyurethane tires. Wheels shall be 5" (130 mm) diameter. Minimum width treads of 1-3/16" (30 mm). Minimum capacity per caster 250 lbs. (115 kg.).			
Q.	Sinks			
	<ol style="list-style-type: none"> <li>1. Fabricated sinks shall have corners same as for metal tops. One piece welded construction with bottom pitched to drains and double wall partitions. Multiple compartments shall have continuous exteriors. Openings between compartments or applied panel will not be accepted.</li> <li>2. Sink insets shall be 16-gauge stainless steel welded as integral part of top.</li> </ol>			
R.	Drawers			
	All drawer pans shall be 18 gauge stainless steel having all corners coved except where specifically noted otherwise. Pan to be mounted on fabricated 14 gauge stainless steel angle cradle frame. Frame to be supported on Component Hardware S52 or approved equal full extension slides with 200 lbs. (91 kg.) capacity per pair. Pan to be easily removable without the use of tools. Drawer fronts shall be double pan type with sound deadening material. Drawer shall be self-closing.			
S.	Doors			
	<ol style="list-style-type: none"> <li>1. All metal doors to be double pan type reinforced and stiffened to prevent flexing and filled with sound deadening material.</li> <li>2. Sliding doors shall be mounted on large ball-bearing quiet rollers in 14 gauge stainless steel overhead tracks and be removable without the use of tools. Sliding doors shall be self-closing.</li> <li>3. Hinged doors shall be flush type, mounted on heavy duty, stainless steel, lift-off hinges, or as specified.</li> <li>4. When specified pulls shall be Component Hardware P62-1010 or approved equal.</li> </ol>			
T.	Hardware			

1. All hardware shall be of heavy duty construction and identified on shop drawings by manufacturer and model number and shall be subject to final approval by Designer.
2. All hardware shall be identified with manufacturer's name and number so that broken or worn parts may be replaced.

U. Breaker Strips

All ice pans, ice bins, refrigerated pans and cabinets shall be provided with breaker strips where adjoining top or cabinet face materials to prevent condensation. Breaker strips shall be fastened with stainless steel, counter sunk screws. Pop rivets will not be acceptable.

V. Insulation

All refrigerator insulation shall be board form or foamed in-place polyurethane. Fiberglass insulation shall not be used. Heated areas shall have minimum of 1" (25 mm) of thick fiberglass/mineral wool 2½" (62 mm) density blanket insulation. Cold areas shall be 1" (25 mm) thick as indicated on details or drawings. Insulation shall be bonded to all surfaces.

W. Refrigerated Items

1. All custom fabricated units to meet NSF-7 criteria.
2. All reach-in refrigerators and freezers with remote refrigeration systems shall be complete with thermostatic expansion valves at the evaporator.
3. Fabricated compartments, refrigerated shelves, plates, etc., shall be provided with a 20 gauge steel box to house expansion valves when valve is remote from evaporator. Install in base of fixtures or in a concealed position.
4. All refrigerated compartments shall be fitted with dial type thermometers with chrome-plated bezels. Thermometers shall be adjustable and shall be calibrated after insulation.
5. Refrigerator hardware for fabricated refrigerator compartments shall be heavy-duty components. Hinges shall be self-closing. Latches to be magnetic edge mount type with cylinder lock unless specified or noted.
6. Refrigerated drawers shall be sized to accommodate two (2) 12" x 20" x 5" (Gastronorm 1/1) steam table pans side by side or as specified or shown on the drawings. Drawer pulls shall be Component Hardware Group, Inc. Model No. P60-1010 or as shown on the drawings. Drawer slides shall be Component Hardware Group S52 Series, 200 pound (91 Kg) capacity, with stainless steel bearings of length as required to suit drawer depth. Drawer front shall be double pan with 18-gauge stainless steel front insulated core and 20-gauge stainless steel back panel. Drawer frame shall be 14-gauge stainless steel.
7. Refrigerator door openings shall be sized to suit 18" x 26" bun pan or as specified or shown on the drawings.

8. Refrigerated bodies shall have extruded snap-on matte gray breaker strip at door and ingredient pan openings. Provide Component Hardware Group PTC T12-5000 condensate evaporator complete with wall mounting bracket.
9. Shelves shall be stainless steel wire installed on stainless steel removable keyhole type pilasters.

## **2.6 STANDARD DETAILS**

Standard Details included as part of drawings are to be considered guides to quality and scope of work involved. Where shop practices dictate, alternate construction methods and component items of equal manufacturer may be substituted. It will be the responsibility of the Kitchen Equipment Contractor to prove the quality of the proposed methods.

## **PART 3 EXECUTION**

### **3.1 DELIVERY AND INSTALLATION**

- A. Delivery
  1. The equipment shall be delivered and installed on schedule. Coordinate all work with the General Contractor and other divisions as required.
  2. Extra charges resulting from special handling or shipment shall be paid by the Kitchen Equipment Contractor if insufficient time was allowed in placing factory orders to ensure normal shipment.
- B. The work shall be accomplished so as not to delay the project construction schedule, interfere or conflict with the work being performed by other contractors. Work shall be coordinated and integrated to prevent conflict of work necessitating changes to work already completed. Should conflicts occur, notify the owner for his coordination in its resolution.
- C. Verify all required field dimensions before fabrication.
- D. Include all alternations to walls, floors and ceiling necessary for work, except otherwise shown or specified, accomplished in a manner satisfactory to the Architect and the Designer. Holes through structural beams shall be prohibited unless written approval has been granted by the Architect.
- E. Cut holes in equipment for pipe, drains, electric outlets, etc, as required for this installation. Work shall conform to highest standards or workmanship and shall include welded sleeves, collars, ferrules or escutcheons.
- F. Repair all damage to the premises as a result of this installation.
- G. Remove daily all debris from the site related to this installation.

FOODSERVICE EQUIPMENT

11 40 00 - 15

- H. Remove any plates, components or component covers installed at the factory before installing the FRP-X panels at cold storage rooms and reinstall them afterwards along with the items furnished loose for mounting on the exterior face of the wall panels.
- I. Space between all equipment to wall, ceiling, floors masonry pads, and adjoining units not portable and with enclosed bodies shall be completely sealed against entrance of food particles or vermin by means of trim strips, welding, soldering or mastic. Mastic shall be General Electric Silicone Construction Sealant Series SE1200 in appropriate color.
- J. All items shall be installed plumb, square, level and in proper elevation, plane location and in alignment with other work.

### **3.2 START-UP & DEMONSTRATION**

- A. All equipment under this section shall be cleaned and ready for operation at time building is turned over to the Owner.
- B. Provide a competent service representative to be present when installation is put into operation. He shall lubricate and put into proper operation all equipment and instruct the Owner's employees in the proper use and maintenance of all items in this contract and set up a maintenance schedule to be followed thereafter. Three (3) copies of the schedule shall be provided before final acceptance of the installation.
- C. During start-up provide all required instruction for operation and maintenance of equipment, after one (1) year guarantee period.
- D. The fire suppression system shall be tested for the authorities in the Owner's presence. Certificates shall be obtained and provided to the Owner from the authorities and from the Fire Insurance Rating Bureau.

## **PART 4 - EQUIPMENT**

### **4.1 REGULAR MANUFACTURED EQUIPMENT**

- A. Provide equipment with standard finishes and accessories unless specifically deleted or superseded by the contract documents.

### **4.2 FABRICATED EQUIPMENT**

- A. Provide arrangement and configuration as shown on plans, elevations and standard detail drawings.

FOODSERVICE EQUIPMENT

11 40 00 - 16

#### 4.3 ITEMIZED FOODSERVICE EQUIPMENT

##### ITEM 1.0 - AIR CURTAIN (1 REQ'D)

<Contractor Provided / Contractor Installed>

Berner SLC07-1072A

Dimensions: 8.5(h) x 72.81(w) x 8.5(d)

Sanitation Series Low Profile Air Curtain, 72"L, unheated, (1) 1/5 hp motor, for doors up to 7' high, specify exterior, interior or exterior mounting, UL, cULus, UL EPH, MADE IN USA

1 ea Five year parts warranty (unheated units)

1 ea 208v/60/1-ph

1 ea White powder coat exterior finish, standard

1 ea Plunger/Roller Door Switch, NEMA 1, max. amp draw of 20 amps, 120-240v/1ph

##### ITEM 2.0 - LOCKER (1 REQ'D)

<Contractor Provided / Contractor Installed>

Winholt Equipment WL-21

Dimensions: 78(h) x 12(w) x 12(d)

Locker, Double Tier, 1 column, 2 lockers per column, 12"W x 12"D x 78"H OA, doors are mesh grid vented, beige

##### ITEM 3.0 - DESK (1 REQ'D)

<Contractor Provided / Contractor Installed>

##### ITEM 4.0 - WIRE SHELVING (1 It REQ'D)

<Contractor Provided / Contractor Installed>

Winco VC Series

Size per plan, includes: (4) sleeve clips per shelf, wire, chrome plated finish, NSF (Qty Break = 2 each)

1 It Model VC-86P Shelf Post, 86"H, chrome plated, NSF

##### ITEM 5.0 - REACH-IN FREEZER (1 REQ'D)

<Contractor Provided / Contractor Installed>

True Mfg STR2F-2S-HC

Dimensions: 77.75(h) x 52.63(w) x 33.75(d)

SPEC SERIES® Freezer, reach-in, two-section, -10°F, (2) stainless steel doors with locks, cam-lift hinges, digital temperature control, (2) interior kits, LED interior lights, stainless steel front & sides, stainless steel interior, 5" castors, R290 Hydrocarbon refrigerant, 1-1/4 HP, 115v/60/1-ph, 9.4 amps, NEMA 5-15P, cULus, UL EPH Classified, Made in USA, ENERGY STAR®

1 ea 7 year compressor warranty, 7 years parts warranty, 7 year labor warranty, standard.

1 ea Left door hinged left, right door hinged right standard

1 kt Left section Spec Kit #4 - (3) chrome shelves & shelf supports

1 kt Right section Spec Kit #4 - (3) chrome shelves & shelf supports

1 st 5" castors (set of 4), standard

##### ITEM 6.0 - REACH-IN REFRIGERATOR (1 REQ'D)

<Contractor Provided / Contractor Installed>

FOODSERVICE EQUIPMENT

11 40 00 - 17

Central Valley CHS

Shafter, CA

DSA Submittal - Feb. 27, 2026

True Mfg. STR2R-2S-HC

Dimensions: 77.75(h) x 52.63(w) x 33.75(d)

SPEC SERIES® Refrigerator, reach-in, two-section, (2) stainless steel doors with locks, cam-lift hinges, digital temperature control, (2) interior kits, LED interior lights, stainless steel front & sides, stainless steel interior, 5" castors, R290 Hydrocarbon refrigerant, 1/2 HP, 115v/60/1-ph, 5.9 amps, NEMA 5-15P, cULus, UL EPH Classified, Made in USA

- 1 ea 7 year compressor warranty, 7 years parts warranty, 7 year labor warranty, standard.
- 1 ea Left door hinged left, right door hinged right standard
- 1 kt Left section Spec Kit #4 - (3) chrome shelves & shelf supports
- 1 kt Right section Spec Kit #4 - (3) chrome shelves & shelf supports
- 1 st 5" castors (set of 4), standard

#### ITEM 7.0 - DECK MOUNT FAUCET (1 REQ'D)

<Contractor Provided / Contractor Installed>

T&S Brass B-1113

Faucet, 4" deck mount, 12" swing nozzle, quarter-turn Eterna cartridges, lever handles, low lead, ADA Compliant

#### ITEM 8.0 - WORK TABLE, WITH PREP SINK(S) (1 REQ'D)

<Contractor Provided / Contractor Installed>

John Boos EPT6R5-3060SSK-L

Dimensions: 40.75(h) x 60(w) x 30(d)

Work Table With Prep Sink, 60"W x 30"D x 40-3/4"H overall size, (1) 16"W x 20" front-to-back x 12" deep sink bowl on left, 5"H backsplash, includes 10" swing spout faucet 4" O.C., 16/300 stainless steel top, stainless steel legs & adjustable undershelf, 1" stainless steel adjustable bullet feet, NSF, CSA-Sanitation, KD

#### ITEM 9.0 - SHELVING, WALL MOUNTED (1 REQ'D)

<Contractor Provided / Contractor Installed>

John Boos BHS1260

Dimensions: 9.5(h) x 60(w) x 12(d)

Shelf, wall-mounted, 60"W x 12"D x 9-1/2"H overall size, 1-1/2" rear up-turn, Stallion Safety Edge front, 18/300 stainless steel, NSF, KD

#### ITEM 10.0 - HAND SINK (1 REQ'D)

<Contractor Provided / Contractor Installed>

John Boos PBHS-ADA-P-STD-SSLR

Dimensions: 24.5(h) x 22(w) x 24(d)

Pro-Bowl Hand Sink, wall mount, 14"W x 16" front-to-back x 5" deep bowl, (1) set of splash mount faucet holes with 4" centers, 1-7/8" drain, drain basket included, left & ride side splashes, soap & towel dispenser, removable front panel, includes mounting bracket, stainless steel construction, ADA compliant, NSF, CSA-Sanitation (Goose neck faucet included with wrist blades)

- 1 kt Splash Mount Faucet Mounting Kit, includes (2) 1/2" supply nipples, (2) retainer nuts, (2) lock washers, (2) rubber washers and (2) male & female short 90° elbows

FOODSERVICE EQUIPMENT

11 40 00 - 18

Central Valley CHS

Shafter, CA

DSA Submittal - Feb. 27, 2026

1 ea P-Trap, 1-1/2" & tail pipe

ITEM 11.0 - SHELVING, WALL MOUNTED (2 REQ'D)

<Contractor Provided / Contractor Installed>

John Boos BHS1248

Dimensions: 9.5(h) x 48(w) x 12(d)

Shelf, wall-mounted, 48"W x 12"D x 9-1/2"H overall size, 1-1/2" rear up-turn, Stallion Safety Edge front, 18/300 stainless steel, NSF, KD

ITEM 12.0 - THREE (3) COMPARTMENT SINK (1 REQ'D)

<Contractor Provided / Contractor Installed>

John Boos 3PB20284-2D30

Dimensions: 44.06(h) x 123.25(w) x 33.5(d)

Pro-Bowl Sink, 3-compartment, 123-1/4"W x 33-1/2"D x 44-1/16"H overall size, (3) 20"W x 28" front-to-back x 14" deep compartments, (2) 30" left & right drainboards, 10"H boxed backsplash with 45° top and 2" return, (1) set of splash mount faucet holes with 8" centers, 3-1/2" die-stamped drain opening, 16/300 stainless steel construction, stainless steel legs, adjustable front & side bracing, adjustable bullet feet, NSF, CSA-Sanitation, KD

1 ea 12" - Disposal cone weld-in (cone supplied by KEC) (modification)

1 ea Customer Supplied Accessories to be Shipped Loose

1 ea Stainless steel disposal switch plate, (11" x 17") (modification)

ITEM 12.1 - DRAIN, LEVER / TWIST WASTE (3 REQ'D)

<Contractor Provided / Contractor Installed>

T&S Brass B-3940

Waste Valve, twist handle, 3" sink opening, 2" drain outlet with 1-1/2" adapter

ITEM 13.0 - PRE-RINSE FAUCET ASSEMBLY, WITH ADD ON FAUCET (1 REQ'D)

<Contractor Provided / Contractor Installed>

T&S Brass B-0133-01

EasyInstall Pre-Rinse Unit, mixing faucet, 8" wall mount, 14" add-on 063X swing nozzle, 18" riser, overhead spring, lever handles, 56" flex hose, Eterna cartridges, spray valve (B-0107), 9" wall support (B-0109-02), 1/2" male NPT, EPA2005 Compliant

ITEM 14.0 - WIRE SHELVING (1 It REQ'D)

<Contractor Provided / Contractor Installed>

Winco VEX Series

Size per plan, includes (4) sleeve clips per shelf, wire, epoxy coated, green, NSF

1 It Model VEX-86P Shelf Post, 86"H, epoxy coated, green, NSF

ITEM 15.0 - CORNER GUARD (2 REQ'D)

<Contractor Provided / Contractor Installed>

John Boos CORNER482-OUT

Dimensions: 4(h) x 48(w) x 4(d)

Corner Guard, outside corner, 2" x 2" x 48"L, 16/300 stainless steel, without holes or adhesive tape backing (to be applied & installed by others in the field)

FOODSERVICE EQUIPMENT

11 40 00 - 19

Central Valley CHS

Shafter, CA

DSA Submittal - Feb. 27, 2026



ITEM 16.0 - WALL CABINET (1 REQ'D)

<Contractor Provided / Contractor Installed>

John Boos WCH-60

Dimensions: 36(h) x 60(w) x 14.5(d)

Cabinet, wall mount, 60"W x 14-1/2"D x 36"H, enclosed design with hinged doors and sloped top, single fixed intermediate shelf, 18/300 stainless steel construction

1 ea Upgrade wall cabinet mid-shelf to be adjustable

ITEM 17.0 - WORK TABLE, 60", STAINLESS STEEL TOP (2 REQ'D)

<Contractor Provided / Contractor Installed>

John Boos ST6-3060SSK

Dimensions: 35.75(h) x 60(w) x 30(d)

Work Table, 60"W x 30"D, 16/300 stainless steel flat top, with Stallion Safety Edge front & back, 90° turndown on sides, box channel understructure with sound deadening tape, stainless steel legs & adjustable undershelf, adjustable bullet feet, NSF, CSA-Sanitation, KD

2 st Casters, 5", heavy duty, locking, for 1-5/8" diameter legs (set of 4)

2 ea Legs cut for casters for a standard 35.75" working height

ITEM 17.1 - WORK TABLE DRAWER (2 REQ'D)

<Contractor Provided / Contractor Installed>

John Boos DR2015-S30

Dimensions: 5(h) x 15(w) x 20(d)

Drawer, for 30"D work tables, 15"W x 20" front-to-back x 5" deep, stainless steel front & drawer pan, roller bearing slides, NSF, for stainless steel table tops only

ITEM 18.0 - RETHERMALIZER/HOLDING CABINET (1 REQ'D)

<Contractor Provided / Contractor Installed>

FWE RH-18-MT

Dimensions: 77.5(h) x 29.25(w) x 39(d)

Retherm & Holding Cabinet, electric, mobile, (18) 18" x 26" trays/baskets or (36) 12" x 20" x 2-1/2 pans capacity, 3" OC spacing adjustable to 1-1/2" increments, adjustable moisture control, touchscreen controls, (8) program presets, heating temperature up to 350° F, holding temperature up to 190° F, insulated, (2) dutch doors, stainless steel construction, 5" casters (2) rigid & (2) swivel with brakes, cULus, UL EPH Classified

1 ea Two year limited parts & one year labor warranty, standard

1 ea 208v/60/1-ph, 49.1 amps, 10,208 watts, cord with NEMA 6-50P, standard (US)

ITEM 19.0 - MOBILE HEATED CABINET (1 REQ'D)

<Contractor Provided / Contractor Installed>

Metro C569-SFS-U

Dimensions: 74.75(h) x 29.13(w) x 32.63(d)

C5™ 6 Series Heated Holding Cabinet, mobile, full height, insulated, solid doors, top mount controls & analog thermometer, ducted heating system, thermostat 70° to 200°F temp, universal wire (18) 18" x 26" or (34) 12" x 20" x 2-1/2" pan capacity, 1-1/2" adjustable wire slides, 5" casters (2 with brakes), 304 stainless steel, 120v/60/1-ph, 2000 watts, 16 amps, NEMA 5-20P, cULus, NSF, ENERGY STAR®

FOODSERVICE EQUIPMENT

11 40 00 - 20

Central Valley CHS

Shafter, CA

DSA Submittal - Feb. 27, 2026

1 ea 1 year warranty against manufacturing defects

ITEM 20.0 - WORK TABLE, 60", STAINLESS STEEL TOP (1 REQ'D)

<Contractor Provided / Contractor Installed>

John Boos ST6R5-3060SBK

Dimensions: 40.75(h) x 60(w) x 30(d)

Work Table, 60"W x 30"D, 16/300 stainless steel top with 5" backsplash, with Stallion Safety Edge front, 90° turndown on sides, box channel understructure with sound deadening tape, stainless steel legs, side & rear adjustable bracing, adjustable bullet feet, NSF, CSA-Sanitation, KD

ITEM 20.1 - WORK TABLE DRAWER (1 REQ'D)

<Contractor Provided / Contractor Installed>

John Boos DR2015-S30

Dimensions: 5(h) x 15(w) x 20(d)

Drawer, for 30"D work tables, 15"W x 20" front-to-back x 5" deep, stainless steel front & drawer pan, roller bearing slides, NSF, for stainless steel table tops only

ITEM 21.0 - MOP SINK (1 REQ'D)

<Contractor Provided / Contractor Installed>

ITEM 22.0 - SERVICE FAUCET (1 REQ'D)

<Contractor Provided / Contractor Installed>

T&S Brass B-0362

Service Sink Faucet, 8" centers, 5-1/4" clearance wall to center line of faucet, 15" from wall to center of outlet, 6" wrist-action handles, 3/4" garden hose threads, integral stops, polished chrome-plated finish, bottom support wall brace

ITEM 23.0 - SHELVING, WALL MOUNTED (1 REQ'D)

<Contractor Provided / Contractor Installed>

John Boos PB-MSS824

Dimensions: 7.5(h) x 8(w) x 24(d)

Utility Shelf, wall-mounted, 24"W x 8"D, Stallion Safety Edge front, 1-1/2" riser on sides & rear, includes hooks & (2) mop/broom holder with locking cam, 16/300 stainless steel, KD

ITEM 24.0 - WATER HEATER (1 REQ'D)

<Contractor Provided / Contractor Installed>

ITEM 25.0 - DISPOSER (1 REQ'D)

<Contractor Provided / Contractor Installed>

Salvajor Model 100-CA-12-MRSS

Disposer, 12" cone assembly, 1 Hp motor, start/stop push button manual reversing MRSS control, includes fixed nozzle, chrome plated vacuum breaker, solenoid valve, scrap ring & flow control, 6-1/2" inlet diameter, heat treated aluminum alloy housing, UL, CE

1 ea 208v/60/1-ph, 10.2 amps

1 ea 12" Stainless steel cone cover

1 ea Disposer support leg, for 3/4 HP - 2 HP disposers

FOODSERVICE EQUIPMENT

11 40 00 - 21

Central Valley CHS

Shafter, CA

DSA Submittal - Feb. 27, 2026

1 ea Mounting bracket for RSS, MSS, MSS-LD, MRSS, MRSS-LD

ITEM 25.1 - DISPOSER CONTROL PANEL (1 REQ'D)

<Contractor Provided / Contractor Installed>

Salvajor MRSS

Start/Stop Push Button, manual reversing control, NEMA 4 stainless steel enclosure

ITEM 26.0 - SPARE NO.

ITEM 27.0 - FLATWARE & TRAY CART (1 REQ'D)

<Contractor Provided / Contractor Installed>

Cambro TC1418110

Dimensions: 45.5(h) x 32.38(w) x 21.25(d)

Tray & Silver Cart, 32-3/8"L x 21-1/4"W x 45-1/2"H, 180-200 tray capacity, includes vinyl cover & (8) clear pans for flatware, napkins & non-perishable condiments, (4) 6" swivel casters, 2 with brake, polyethylene, black, NSF, Made in USA

ITEM 28.0 - SERVING COUNTER, COLD FOOD (2 REQ'D)

<Contractor Provided / Contractor Installed>

Cambro VBR6110

Dimensions: 62.75(h) x 82(w) x 42.5(d)

Versa Food Bar™ Serving Buffet, cold food, 6 ft. unit, 82"L x 42-1/2"W x 62-3/4"H, holds (5) full size food pans, accommodates various size food pans up to 6", cooled with optional Camchillers® or ColdFest®, double-wall polyethylene, molded-in handles, threaded faucet drain, non-electrical, (4) 6" swivel casters with brakes, black, NSF, Made in USA

4 ea Versa Tray Rail Only, for 6 ft. Versa Food Bar™, granite gray, NSF, Made in USA

1 ea Connector, 27"L x 19"W x 4-1/4"H, straight, for Versa Food Bar™, black, NSF, Made in USA

ITEM 29.0 - MILK COOLER (1 REQ'D)

<Contractor Provided / Contractor Installed>

Beverage Air ST49HC-S

Dimensions: 41.13(h) x 49(w) x 31.25(d)

School Milk Cooler, cold wall, normal temperature, 49"W x 31-1/4"D x 41-1/8"H, 18.97 cu. ft., dual access, flat top carton capacities, (12) 13" x 13" x 11" or (8) 19" x 13" x 11 case capacities, self-latching doors/lids with safety bumpers, cylinder lock, wire floor racks, electronic control, manual defrost, stainless steel interior & exterior, R290 Hydrocarbon refrigerant, 1/2 HP, cULus, UL EPH Classified, UL-Sanitation

1 ea 7 year parts & labor and 7 year compressor warranty (excludes maintenance items)

1 ea 115v/60/1-ph, 3.7 amps, cord with NEMA 5-15P

1 ea 4" Heavy duty casters, (2) with brakes, standard

ITEM 30.0 - CASH REGISTER STAND (1 REQ'D)

<Contractor Provided / Contractor Installed>

Cambro ES28RL110

FOODSERVICE EQUIPMENT

11 40 00 - 22

Central Valley CHS

Shafter, CA

DSA Submittal - Feb. 27, 2026

Dimensions: 39(h) x 44(w) x 28(d)

Equipment Stand, 44"W x 28"D x 39"H, with tray rails on right & left sides of drawer,  
polyethylene, (4) 5" casters (2 fixed and 2 swivel with brakes), black, NSF, Made in USA

1 ea Special Order item not carried in stock; NON-Returnable, (1) full case minimum

ITEM 31.0 - P.O.S. SYSTEM (1 REQ'D)

<Contractor Provided / Contractor Installed>

## **END OF SECTION**

FOODSERVICE EQUIPMENT

11 40 00 - 23

Central Valley CHS

Shafter, CA

DSA Submittal - Feb. 27, 2026

**SECTION 12 24 13**  
**ROLLER WINDOW SHADES**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes.
  - 1. Manual operation shades.

**1.2 ACTION SUBMITTALS**

- A. Product Data:
  - 1. Each roller shade type.
  - 2. Initial selection color charts for shadeband fabric and metal finish.
- B. Shop Drawings: Show shades on floor plans or reflected ceiling plans.
  - 1. Each installation area; include anchorage details.
  - 2. Locations of control stations and units included in control zones.
- C. Schedules:
  - 1. Types by location. Include operation and appearance attributes.
- D. Samples:
  - 1. Shadeband Fabrics: 8 by 8 inch Samples of each type.
  - 2. Fascia: 8 inch Samples in required colors.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Qualification Statements: Manufacturer and installer.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: Include full parts list; shadeband fabric cleaning precautions.
- B. Warranty documentation.

**1.5 MAINTENANCE MATERIAL SUBMITTALS**

- A. Tools: Manufacturer recommended [special tools] required to maintain shade systems.

## **1.6 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Installer: Manufacturer authorized or trained.
- B. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.
- C. Shade Cloth Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC9644 and ATCC9645, and E2180.
- D. Shade Cloth Cleanability and Disinfecting: Shade Cloth must meet cleanability and disinfecting requirements via 3rd party testing to comply with BIFMA HCF 8.1-2014 standards using chemical solutions compliant with EPA guidelines for use against COVID-19.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Storage and Handling Requirements:
  - 1. Store roller shades inside building after enclosure.
  - 2. Mark packaging with installation location using Drawing room designations.

## **1.8 FIELD CONDITIONS**

- A. Ambient Conditions: Perform Work within following limitations:
  - 1. Building enclosed and environmental systems maintaining design conditions for Owner occupancy.
- B. Existing Conditions: Verify field measurements before fabrication. Show field measurements on Shop Drawings.

## **1.9 WARRANTY**

- A. Manufacturer Warranties:
  - 1. Warrant against product failure.
    - a. Hardware: Ten years.
    - b. Shade Fabric: 25 years.

## **PART 2 PRODUCTS**

### **2.1 MANUAL OPERATION SHADES**

- A. Manually Operated Roller Shades:
  - 1. Manufacturers and Products:
    - a. MechoShade Systems, Inc. Mecho /5 (Basis-of-Design).
    - b. Draper, Inc. FlexShade.
    - c. Hunter Douglas Contract RB 500 + Manual.

- d. Inpro WT Shade H200 SoloMount.
- 2. Shade Type: Single roller.
- B. Drop Position: Regular roll.
- C. Mounting: Wall.
- D. Shade Fabric: Color fast, impervious to heat and moisture, and able to retain shape under exposure to sunlight through windows; NFPA 701 and WCMA A100.1.
  - 1. Fabric Type: PVC-coated polyester.
  - 2. Mold Resistance: No Growth per ASTM G21 results for fungi ATCC9642, ATCC9644, and ATCC9645.
  - 3. Fire Test Response Characteristics: Passes NFPA 701 small and large scale vertical burn tests.
  - 4. Solar Control Shade Fabric:
    - a. Openness: 1 percent.
    - b. Weave Pattern: Architect selected.
    - c. Color: Architect selected.
- E. Shade Fabric Attachment: Replaceable without disassembly.
- F. Hembars: Maintain bottom edge straight and flat.
  - 1. Style: Exposed.
- G. Clutch Operator: Permanently lubricated, continuous loop chain and crank operation.
  - 1. Universal Cord Tensioning Device: ANSI/WCMA A100.1.
  - 2. Reduced Operating Force: 8.5 pounds maximum.
- H. Accessible Operating Mechanisms:
  - 1. Where required, provide ADA-compliant manual shade operating mechanism.
  - 2. Manufacturers: Subject to compliance with requirements, provide accessible operators for roller shades as provided by one of the following:
    - a. Mecho: ADA Manual Shade Control.
    - b. Or Equal.
- I. Accessories:
  - 1. Fascia: Extruded aluminum; conceals shade mounting and roller without exposed fasteners.
    - a. Finish: Clear anodized.

## **2.2 PERFORMANCE**

- A. Accessibility Requirements: Applicable provisions in Department of Justice publication 2010 ADA Standards for Accessible Design, ICC/ANSI A117.1, and state accessibility code.

## **2.3 FABRICATION**

- A. Height: Fill openings from head to within 1/2 inch of stool.

- B. Width, Outside Mount: Lap jambs 3/4 inch.
- C. Continuous Windows With Separate Rollers: Butt rollers end to end centered on window mullions.

## **2.4 FINISHES**

- A. Anodizing: AAMA 611 Class I or AAMA 612 with electrodeposition organic seal.
  - 1. Color: Architect Selected.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify concealed support locations for attachment.

### **3.2 INSTALLATION**

- A. Install roller shades level, aligned with adjacent units, and centered on openings.
- B. Install jamb guides plumb and aligned with shadeband drop.

### **3.3 CLEANING AND PROTECTION**

- A. Clean metal and fabric surfaces.
- B. Protect installed products until completion of project.

### **3.4 CLOSEOUT ACTIVITIES**

- A. Demonstration: Train Owner staff on operation and maintenance.

## **END OF SECTION**



## **SECTION 12 36 00**

### **COUNTERTOPS**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes.
  - 1. Plastic laminate countertops.
  - 2. Solid surface countertops.
  - 3. Epoxy laboratory countertops.
  - 4. Countertop hardware.
- B. Related Requirements.
  - 1. Section 06 41 13 "Wood Veneer Faced Architectural Cabinets".
  - 2. Section 06 41 16 "Plastic Laminate Clad Architectural Cabinets".

##### **1.2 REFERENCES**

- A. Abbreviations and Acronyms:
  - 1. HPDL: High Pressure Decorative Laminate.
- B. Definitions:
  - 1. Sheen Levels: ASTM D523.
    - a. Flat: Five gloss units at 60 degrees and 10 gloss units at 85 degrees, maximum.
    - b. Satin: 20 to 35 gloss units at 60 degrees and 35 gloss units minimum at 85 degrees.
    - c. Semigloss: 35 to 70 gloss units at 60 degrees.
    - d. Gloss: 70 gloss units at 60 degrees, minimum.
  - 2. <Term: Definition>.

##### **1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination Procedures:
  - 1. Coordinate locations of utilities and accessories penetrating countertops.
  - 2. Coordinate sizes and layouts with base cabinets.

##### **1.4 ACTION SUBMITTALS**

- A. Certification Labels: WI Certified Compliance Program.
- B. Product Data:
  - 1. Countertop materials.

- 2. Adhesives.
  - 3. Initial selection color charts and Samples.
- C. Shop Drawings:
  - 1. Dimensioned plans and elevations showing countertop locations.
  - 2. Show materials, profiles, assembly methods, joint details, fastening methods, cutout sizes and locations, and finishes.
- D. Samples:
  - 1. Plastic Laminates: 8 by 10 inches, minimum.
  - 2. Countertop Material: 6 inches square.
  - 3. Grommets: Each type and color.

## **1.5 INFORMATIONAL SUBMITTALS**

- A. Woodworker Quality Certificates: WI Certified Compliance Program.

## **1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For all countertop types.

## **1.7 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Fabricator: WI Certified Compliance Program licensee.
  - 2. Installer: WI Certified Compliance Program licensee.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Storage and Handling Requirements: Woodwork Institute NAAWS.

## **1.9 FIELD CONDITIONS**

- A. Ambient Conditions: Perform Work within following limitations:
  - 1. Building enclosed and environmental systems maintaining design conditions for Owner occupancy.
- B. Existing Conditions: Verify field measurements before fabrication. Show field measurements on Shop Drawings.

# **PART 2 PRODUCTS**

## **2.1 COUNTERTOP GENERAL REQUIREMENTS**

- A. Quality Standard: Woodwork Institute NAAWS for aesthetic grades and performance.

## **2.2 PLASTIC LAMINATE COUNTERTOPS**

- A. HPDL Countertops: ISO 4586-3.
  - 1. Grade: Custom.
  - 2. Manufacturers and Products: See Finish Legend on Drawings.
  - 3. Manufacturers and Products:
    - a. Wilsonart, as basis of design.
    - b. Formica
    - c. Or approved equal.
  - 4. Grade: HGS.
  - 5. Pattern Direction: Parallel to countertop.
  - 6. Core Material: Exterior grade veneer core plywood.
  - 7. Edge Treatment: HPDL edge.
  - 8. Edge profile: Waterfall typical. Provide no-drip at lengths with sinks.
  - 9. Backer Sheet: HPDL; NEMA LD 3, Grade BKL.
- B. Installation Materials:
  - 1. Adhesives: Laminate manufacturer recommended, VOC complaint.
  - 2. Fasteners: Type, size, and material to suit each application.

## **2.3 SOLID SURFACE COUNTERTOPS**

- A. Solid Surface Countertops: IFSA 2-01, homogeneous resin sheets.
  - 1. Manufacturers and Products:
    - a. Wilsonart, as basis of design.
    - b. Formica Everform.
    - c. Corian.
  - 2. Color: Basalt Concrete.
  - 3. Configuration: See Drawings.
    - a. Fronts: Built up to 1-1/2 inch thick, mitered with slightly eased straight edges.
    - b. Backsplashes and Endsplashes: Slightly eased straight edges.
    - c. Endsplashes: Slightly eased straight edges.
  - 4. Thickness: 1/2 inch self supporting.
- B. Installation Materials:
  - 1. Adhesives: Countertop fabricator recommended, VOC compliant.
  - 2. Fasteners: Type, size, and material to suit each application.

## **2.4 EPOXY LABORATORY COUNTERTOPS**

- A. A. Epoxy:: Factory-molded, modified epoxy-resin formulation with smooth, non-specular finish.
  - 1. Grade: Premium.
  - 2. Manufacturers and Products: See Finish Schedule and Finish Legend on Drawings.
  - 3. Manufacturers and Products:
    - a. Kewaunee Kemresin, as basis of design.
    - b. Durcon Incorporated.

- c. Prime Industries, Inc.
  - d. Thermo Fisher Scientific, Inc.
  - e. Or approved equal.
  - 4. Physical Properties:
    - a. Flexural Strength: Not less than 15,000 psi.
    - b. Compressive Strength: 30,000 psi.
    - c. Modulus of Elasticity: Not less than 2,000,000 psi.
    - d. Hardness (Rockwell M): Not less than 100.
    - e. Water Absorption (24 Hours): Not more than 0.02 percent.
    - f. Heat Distortion Point: Not less than 350 deg F.
    - g. Thermal-shock Resistance: Highly resistant.
  - 5. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
    - a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
    - b. Moderate Effect: Sodium hydroxide (50 percent).
    - c. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).
  - 6. Thickness: 1 inch.
  - 7. Exposed edges radius: 1/4 inch.
  - 8. Back splash: 6 inches high or as noted otherwise on Drawings.
  - 9. Factory cut for sinks, and utility fittings.
  - 10. Factory installed Rod Sockets. MINIMUM of two (2) rod sockets at each sink location.
- B. Installation Materials:
- 1. Adhesives: Countertop fabricator recommended, VOC compliant.
  - 2. Fasteners: Type, size, and material to suit each application.

## **2.5 COUNTERTOP HARDWARE**

- A. Countertop Supports: Steel Surface mounted T brackets, L shaped configuration.
  - 1. Manufacturers and Products:
    - a. A&M Hardware.
    - b. KV Ultimate L-Bracket
    - c. Or approved equal.
  - 2. Finish: Powder coat.
    - a. Color: Architect selected.

## **2.6 MATERIALS**

- A. Fire Retardant Treated Wood:
  - 1. Chemically treated and pressure impregnated.
  - 2. Flame Spread: 25, maximum per ASTM E84.
  - 3. Label or otherwise identify fire retardant treated material.
  - 4. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

## **2.7 FABRICATION**

- A. Shop assemble Work for delivery to site, permitting passage through building openings.
- B. When necessary to cut and fit on site, fabricate materials with ample allowance for cutting. Furnish trim for scribing and site cutting.
- C. Fabrication Tolerances:
  - 1. Wood Based and Solid Surface Countertops: ANSI/AWI 0620, specified grade.
  - 2. Wood Based and Solid Surface Countertops: Woodwork Institute NAAWS, specified grade.
- D. Finish exposed edges of countertops and back and end splashes.
- E. Stone and Quartz Agglomerate Countertop Fabrication:
  - 1. Natural Stone Institute Dimension Stone Design Manual.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Surface Preparation: Follow ANSI/AWI 0620.
- B. Surface Preparation: Follow Woodwork Institute NAAWS.
- C. Conditioning:
  - 1. Acclimate products to installation environment per Woodwork Institute NAAWS.

### **3.2 INSTALLATION**

- A. Follow Woodwork Institute NAAWS.
- B. Installation Grade: Custom.
- C. Cut openings for plumbing fixtures, electrical devices, and accessories.
- D. Install countertop fasteners in concealed locations.
- E. Align edge surfaces. Support to prevent deflection and lippage.
- F. Interface with Adjacent Work: Seal gaps between tops, splashes, and walls with mildew resistant sealant specified in Section 079200.

### **3.3 FIELD QUALITY CONTROL**

- A. Field Tests and Inspections: Inspections provided through WI Certified Compliance Program. Program inspectors will perform installation inspection and prepare reports. Allow inspectors access to Work areas.
  - 1. Failed Reinspection Cost: Contractor responsibility.
- B. Non Conforming Work: Remove and replace, and retest.

### **3.4 CLEANING**

- A. Clean countertops and splashes; remove excess sealant from adjacent surfaces.

### **3.5 PROTECTION**

- A. Protect countertops from soil and damage during remainder of construction.

**END OF SECTION**

## **SECTION 12 48 13**

### **ENTRANCE FLOOR MATS AND FRAMES**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Entrance mats.

##### **1.2 ACTION SUBMITTALS**

- A. Product Data:
  - 1. Types of entrance mats and frames.
  - 2. Initial selection color charts and Samples.
- B. Shop Drawings:
  - 1. Show dimensions, details and frame characteristics.
- C. Samples:
  - 1. Floor Mats: 12 by 12 inches.

##### **1.3 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: Including maintenance data and stain removal instructions.

##### **1.4 FIELD CONDITIONS**

- A. Existing Conditions: Verify field measurements before fabrication. Show field measurements on Shop Drawings.

#### **PART 2 PRODUCTS**

##### **2.1 ENTRANCE MATS**

- A. Carpet Walk-Off Mats: Framed.
  - 1. Manufacturers and Products:
    - a. Construction Specialties BR DesignStep "Duration" Style Entrance Carpeting.
    - b. Interface Step Repeat SR899.
    - c. ShawContract Welcome II.
    - d. Tarkett Assertive Stria.

2. Carpet: Nylon, Polypropylene, or Polyester carpet bonded to rubber backing with matching rubber border on exposed edges.
  - a. Color and Pattern: Architect selected.

## **2.2 FRAMES**

- A. Surface Mounted Frames: Tapered vinyl edge frame, 1-1/2 inches minimum width with welded mitered corners.
  1. Vinyl Color: Architect selected.

## **2.3 PERFORMANCE**

- A. Accessibility Requirements: Applicable provisions in Department of Justice publication 2010 ADA Standards for Accessible Design, ICC/ANSI A117.1, and state accessibility code.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

### **3.2 PREPARATION**

- A. Surface Preparation:
  1. Clean floor substrates per manufacturer's recommendations.

### **3.3 INSTALLATION**

- A. Coordinate top of mat surfaces with bottom of doors that swing across to provide ample clearance between door and mat.
- B. Floor preparation, temperature and proper glue methods in accordance with Manufacturer's installation instructions.

### **3.4 ADJUSTING**

- A. Adjust floor mats and frames to prevent tripping hazards.



### **3.5 PROTECTION**

- A. Protection: Protect installed products and finish surfaces during remainder of construction period.

**END OF SECTION**

**SECTION 21 05 00  
COMMON WORK RESULTS FOR FIRE SUPPRESSION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Above ground piping.
- B. Escutcheons.
- C. Expansions - hose and braid.
- D. Mechanical couplings.
- E. Pipe hangers and supports.

**1.2 RELATED REQUIREMENTS**

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. Section 21 05 23 - General-Duty Valves for Water-Based Fire-Suppression Piping.
- C. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment: Piping identification.
- D. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.
- E. Division 22 - Plumbing
- F. Division 23 - HVAC
- G. Division 26 - Electrical
- H. Division 28 - Electronic Safety and Security

**1.3 REFERENCE STANDARDS**

- A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
- C. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2021.
- D. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard; 2025.
- E. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings; 2024.
- F. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded; 2021.
- G. ASME B16.25 - Buttwelding Ends; 2022.
- H. ASME B36.10M - Welded and Seamless Wrought Steel Pipe; 2022.

- I. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).
- J. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
- K. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2021.
- L. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2024.
- M. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2024.
- N. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2021.
- O. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.
- P. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.
- Q. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2023.
- R. AWWA C606 - Grooved and Shouldered Joints; 2022.
- S. ITS (DIR) - Directory of Listed Products; Current Edition.
- T. NFPA 13 - Standard for the Installation of Sprinkler Systems: 2022
- U. NFPA 24 - Standard for the Installation of Private Fire Service Mains and their Appurtenances; 2022
- V. NFPA 25 - Standard for the Testing, Inspection, and Maintenance of Water Based Fire Suppression Systems; 13CA
- W. NFPA 72 - National Fire Alarm and Signaling Code; 2022
- X. UL (DIR) - Online Certifications Directory; Current Edition.
- Y. California Building Code; 2022
- Z. California Fire Code; 2022

#### **1.4 SUBMITTALS**

- A. Contractor to include items listed in product section along with any additional items required to provide a complete and fully functioning installation per NFPA 13 and all adopted building and fire codes.
- B. Product Data: Provide manufacturer's catalog information. Where more than one product or model is available, provide red marking arrows or highlights on the cut sheets to clearly identify the product models, finishes, orientations, and any further clarification needed of the intended products for use, to complete a thorough review.

- C. Contractor Shop Drawings: Used for coordination and as installation drawings to indicate materials and finishes used, joint methods, pipe supports, elevations, floor and wall penetration details, and sealing methods. Indicate installation layout, hanger layout, weights, mounting and support details, seismic restraints with calculations, and piping connections.
- D. Engineers review of submittals does not relieve Contractor from coordinating installation of work with other trades, or from compliance with Codes and Standards.
  - 1. Copies of engineers drawings cannot be used as the contractors installation drawings for review. Engineers drawings are used for submittal and approval to DSA only and do not show the contractors continued coordination with other trades, fabricated lengths of pipe, or appropriate take-outs for fittings.
- E. Project Record Documents: Record actual locations of components and tag numbering for final as built in clients O&M's.
- F. Operation and Maintenance Data: Include As-Built drawings, equipment and material data sheets, installation instructions, and spare parts lists.
- G. Provide Owner with the following:
  - 1. Manufacturer's literature and instructions describing operation and maintenance of equipment and devices installed.
  - 2. Typewritten chart with identification and location of all access panels serving equipment and valves. Incorporate into Operation & Maintenance (O&M) manual.
  - 3. Typewritten valve schedule indicating valve number, fixture/equipment or areas served by each numbered valve. Incorporate into O&M manual.
  - 4. 8-1/2 x 11 laminated flow diagram showing isolation valve locations, drain valve locations, and system boundaries, where applicable, and attach it to the system riser.
  - 5. Current copy of NFPA 25 – Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
  - 6. Contractors As-builts of final installation.

## **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Fabrication shop must provide welding certifications and copy of weld stamp when requested. Weld stamp to be provided on all pipe at welds.
- C. Contractor Qualifications: Provide licensed persons employed by sprinkler contractor to perform planning, calculations, layout, installation, and testing of fire protection systems. The following are acceptable:
  - 1. Licensed Professional Engineer

- 2. National Institute for Certification of Engineering Technologies (NICET) Level III
- 3. Certified sprinkler designer
- D. Installer Qualifications: Company specializing in performing the work of this section shall provide journeyman sprinkler fitter(s) for installation and supervision with minimum 5 years experience.
- E. Contractor shall be licensed in the State of California for installation of fire protection systems.
- F. Comply with UL (DIR) requirements.
- G. Valves: Bear UL (DIR) product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- H. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.
- I. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to the site under provisions of Division 01
- B. Store and protect products under provisions of Division 01
- C. All materials shall be stored in a clean, dry space.
- D. Promptly inspect shipments to ensure material is undamaged and complies with Specifications. Storage and protection methods must allow inspection to verify products.
- E. Deliver and store valves in shipping containers, with labeling in place.
- F. Provide temporary protective coating on cast iron and steel valves.
- G. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- H. Furnish pipe with plastic end-caps/plugs on each end of pipe. Maintain end-caps/plugs through shipping, storage and handling, and installation to prevent pipe-end damage and to eliminate dirt and construction debris from accumulating inside of pipe. Protect fittings and unions by storage inside or by durable, waterproof, aboveground packaging.
- I. Cover pipe and fitting to prevent rust, corrosion, or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade.
- J. Offsite storage agreements will not relieve Contractor from using proper storage techniques.

#### **PART 2 PRODUCTS**

## **2.1 GENERAL REQUIREMENTS**

- A. Sprinkler Systems: Conform work to NFPA 13.
  - 1. Follow DSA requirements
- B. Comply with all building and fire code adoptions for the project location.
- C. Welding Materials and Procedures: Comply with ASME BPVC-IX.
- D. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

## **2.2 BURIED PIPING:**

### **2.3 PIPING TO 5'-0" OUTSIDE BUILDING FACE**

- A. Ames ES.A - Series IBR - In Building Riser
- B. Steel Pipe: ASTM A 53/A 53M Schedule 40 or ASTM A 795 Standard Weight, galvanized, with AWWA C105 polyethylene jacket, or double layer, half-lapped polyethylene tape.
- C. Ductile Iron Pipe: AWWA C151/A21.51. Ductile iron, Class 52, American Water Works Association (AWWA) C151, minimum 350 psi working pressure, with standard cement mortar lining, AWWA C104, American National Standards Institute (ANSI) A21.4
  - 1. Fittings: AWWA C110/A21.10, Ductile iron or grey iron, mechanical joint, 350 psi working pressure, AWWA C153, cement mortar lined, AWWA C104.
  - 2. Encasement: Polyethylene encasement, 0.2 mm(8 mil) thick, AWWA C105
  - 3. Joints: AWWA C111/A21.11, styrene-butadiene rubber (SBR) or vulcanized SBR gasket.
  - 4. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

### **2.4 ABOVE GROUND PIPING**

- A. Carbon Steel Pipe 2" and smaller: ASTM A53 Schedule 40 or ASTM A795 Schedule 40, black or galvanized.
  - 1. Fittings: ASME B16.9 wrought steel, buttwelded, ASTM A234/A234M wrought carbon steel or alloy steel, or ASME B16.5 steel flanges and fittings.
    - a. Cast Iron Flanged Fittings: ASME B16.1, flanges and flanged fittings.
    - b. Cast Iron Threaded Fittings: Class 125, ANSI B16.4, 175 psi CWP rating.
    - c. Malleable Iron Threaded Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M class 150, 300 psi CWP rating, ASME B16.3

- d. Ductile Iron Threaded Fittings: ASME B16.3, ASTM A536 Grade 65-45-12, thread per ASME B1.20.1; shall be UL listed for fire protection use.
    - 1) Ductile iron threaded fittings have higher tensile strength than that of steel pipe. Therefore, over tightening can cause damage to pipe threads which may cause leakage and/or facilitate aggressive internal pipe corrosion. Ductile iron fittings should be tightened approximately three turns beyond hand tight, but no more than four turns, per manufacturer. Any deficiencies or damage caused to owners system or property due to over-tightening, shall be the full liability and responsibility of the contractor to pay for and correct.
  - e. Carbon steel butt weld, ASTM A234 Grade WPB/American Society of Mechanical Engineers (ASME) B16.9, standard weight, seamless.
  - f. Ductile iron or malleable iron, roll grooved for mechanical coupling: ASTM A47, 175 psi CWP rating, malleable iron.
    - 1) Fitting, gasket, and coupling shall be furnished by same manufacturer.
  - g. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
  - h. Mechanical formed fittings: ASME 16.9, including, but not limited to, tees, saddle fittings, bushings and mechanical sprinkler head fittings shall not be used.
2. Joints:
- a. Threaded, tapered pipe threads, ANSI B1.20.1
  - b. Flanged, cast iron, 175 psi CWP rating, ANSI B16.1, square head machine bolts with semi-finished hexagon nuts, ASTM A183, neoprene gasket
  - c. Welded, welding electrodes shall be Lincoln or equal with coating and diameter as recommended by manufacturer for type and thickness of work being done.
  - d. Mechanical:
    - 1) Flexible mechanical, malleable iron, ASTM A47, equal to Victaulic Style 75
    - 2) Rigid mechanical, ductile iron, ASTM A-536, equal to Victaulic Style 009N or 009V
    - 3) Wet systems gasket: Grade E EPDM gasket per UL 157 and UL 213
    - 4) Rigid or zero flex type couplings shall be provided when operating pressures cause piping to move out of place or

sway on hangers. Flexible couplings may be used where pipe is braced or clamped into rigid position.

- B. Carbon Steel Pipe 2-1/2" and larger: Schedule 10 pipe ASTM A795, ASTM A135, black or galvanized.
  - 1. Fittings:
    - a. Carbon steel butt weld, ASTM A234 Grade WPB/ASME B16.9, Schedule 10, seamless
    - b. Ductile iron or malleable iron, roll grooved for mechanical coupling, 175 psi CWP rating, malleable iron conforming to ASTM A47.
      - 1) Fitting, gasket, and coupling shall be furnished by same manufacturer.
  - 2. Joints:
    - a. Welded, welding electrodes shall be Lincoln or equal with coating and diameter as recommended by manufacturer for type and thickness of work being done.
    - b. Mechanical:
      - 1) Flexible mechanical, malleable iron, ASTM A47, equal to Victaulic Style 75
      - 2) Rigid mechanical, ductile iron, ASTM A-536, equal to Victaulic Style 009N or 009V
      - 3) Wet systems gasket: Grade E EPDM gasket per UL 157 and UL 213
      - 4) Rigid or zero flex type couplings shall be provided when operating pressures cause piping to move out of place or sway on hangers. Flexible couplings may be used where pipe is braced or clamped into rigid position.
- C. Plain end couplings (Roust-A-Bouts, Plainloks or similar couplings) are not allowed on either new or existing sprinkler systems.
- D. Adjustable drop nipples are not allowed on either new or existing sprinkler systems.
- E. All fittings for galvanized pipe shall match the pipe finish and be galvanized.
- F. Clamp-on or saddle type fittings (i.e. mechanical tees or tee lox) are not allowed on new pipe. Outlet fittings inserted into holes drilled into piping are not allowed.

## **2.5 ESCUTCHEONS**

- A. Material:
  - 1. Fabricate from nonferrous metal.
  - 2. Chrome-plated.
- B. Construction:
  - 1. Mounting on pipe use split-pattern or split ring type.

## **2.6 PIPE HANGERS AND SUPPORTS**



- A. Provide hangers and associated parts to support piping in perfect alignment without sagging or interference, to permit free expansion and contraction, and meet requirements of NFPA 13 and manufacturer's installation instructions.
  - 1. All hanger materials shall be listed for fire protection use.
- B. Select and size building attachments per Manufacturer Standardization Society (MSS) standards and manufacturer's published load rating.
- C. Coordinate hanger support installation to group piping of all trades.
- D. Hang pipe from building members using either concrete inserts for concrete construction or beam clamps for steel construction. Installation shall comply with manufacturer's installation instructions. Expansion type inserts may be used for branch piping.
- E. Suspend hangers by means of electroplated zinc or hot-dipped galvanized finish hanger rods, attachments, and supports.
- F. Support pipe from top flange of beams.
- G. Do not support equipment or piping from metal roof deck that does not have a concrete poured top.
- H. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
  - 1. Manufacturers:
    - a. Eaton; [www.eaton.com](http://www.eaton.com); Tolco Fire Protection Solutions.
    - b. Anvil International; [www.anvilintl.com/#sle](http://www.anvilintl.com/#sle).
- I. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, swivel ring.
  - 1. Manufacturers:
    - a. Anvil International; [www.anvilintl.com/#sle](http://www.anvilintl.com/#sle).
    - b. Eaton; [www.eaton.com](http://www.eaton.com); Tolco Fire Protection Solutions
- J. Vertical Support: Steel riser clamp.
  - 1. Manufacturers:
    - a. Anvil International: [www.anvilintl.com/#sle](http://www.anvilintl.com/#sle).
    - b. Eaton; [www.eaton.com](http://www.eaton.com); Tolco Fire Protection Solutions.
- K. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support. Pipe stands shall be provided with a galvanized finish and be anchored into the floor.
  - 1. Manufacturers:
    - a. Anvil International: [www.anvilintl.com/#sle](http://www.anvilintl.com/#sle).
    - b. Eaton; [www.eaton.com](http://www.eaton.com); Tolco Fire Protection Solutions.
- L. Seismic Hangers:
  - 1. Restraining clips/clamps are required in locations where vibration may be a concern.

2. Install flexible fitting at building's expansion or seismic joints per manufacturer's instructions.
3. All seismic hangers shall be listed for fire protection use.
4. Manufacturers:
  - a. Anvil International Seismic Bracing Products.
  - b. Eaton: Tolco Fire Protection Solutions.

## **2.7 EXPANSION JOINTS AND LOOPS - HOSE AND BRAID**

- A. Manufacturers:
  1. The Metraflex Company; FireLoop: [www.metrafire.com/#sle](http://www.metrafire.com/#sle).
- B. Provide flexible loops with two flexible sections of hose and braid, two 90-degree elbows, and 180-degree return with support bracket and air release or drain plug.
- C. Provide flexible loops capable of movement in the x, y, and z planes. Flexible loops to impart no thrust loads to the building structure.
- D. Flexible Connectors: Grooved, braided type with wetted components of stainless steel, sized to match piping.
  1. Maximum Allowable Working Pressure: 150 psig at 120 degrees F.
  2. Provide necessary accessories including, but not limited to, swivel joints.

## **2.8 MECHANICAL COUPLINGS**

- A. Manufacturers:
  1. Tyco Fire Protection Products: [www.tyco-fire.com/#sle](http://www.tyco-fire.com/#sle).
  2. Victaulic Company: [www.victaulic.com/#sle](http://www.victaulic.com/#sle).
- B. Rigid Mechanical Couplings for Grooved Joints:
  1. Dimensions and Testing: Comply with AWWA C606.
  2. Minimum Working Pressure: 300 psig.
  3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
  4. Housing Coating: Factory applied orange enamel or galvanized finished.
  5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
  6. Bolts and Nuts: Hot-dipped-galvanized or zinc-electroplated steel.
  7. Couplings provided shall be from the same manufacturer of the fitting manufacturer.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

### **3.2 INSTALLATION**

- A. Install hydraulically designed sprinkler system and associated accessories according to NFPA 13 and as shown on the contract drawings.
- B. Install pipe, fittings, couplings, and valves according to requirements of manufacturer.
- C. Pipe and fittings shall be of corresponding materials when assembled.
- D. Where galvanized pipe is used, hangers, seismic braces, and fittings shall match the pipe type and also be galvanized or zinc coated.
- E. Group piping whenever practical at common elevations, taking into account space needed by other trades.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Pipe Hangers and Supports:
  - 1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 2. Place hangers within 12 inches of each horizontal elbow.
  - 3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  - 5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- H. Provide auxiliary drains at low points of systems per requirements of NFPA 13.
- I. Do not penetrate building structural members unless indicated.
- J. Provide sleeves when penetrating footings, floors, and walls. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
  - 1. Non bearing wall partitions shall not require sleeves or to be provided with clearances.
  - 2. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
    - a. Fill hole clearance with pea gravel or insulation and caulk.
- K. Escutcheons:
  - 1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
  - 2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
  - 3. Use split chrome plated escutcheons in occupied spaces to conceal openings for wall and ceiling penetrations.

- L. Die-cut threaded joints with full-cut, standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.
- M. Use joint compound sparingly.
- N. Provide reducing fittings or provide shop fabricated weld-o-lets to change pipe sizes in sprinkler/standpipe systems.
  - 1. No bushings or grooved reducing couplings, such as Victaulic Style 750, are allowed.
- O. Coat exposed threads when exposed to outside elements or where located in an attic space, with rust inhibiting paint equal to Rust-Oleum.
  - 1. Pipe dope and tape are not approved equivalents.
  - 2. Provide black paint with black pipe and silver paint with galvanized pipe.
  - 3. Wipe threads clean with a cloth and use spray can application to coat threads only.
    - a. Overspray on pipe and/or fitting is not of concern.

### **3.3 CLEANING**

- A. Upon completion of work, clean all parts of the installation.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

**END OF SECTION**

**SECTION 21 05 23**  
**GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Bronze butterfly valves with indicators.
- B. Iron butterfly valves with indicators.
- C. Check valves.
- D. Bronze OS&Y gate valves.
- E. Iron OS&Y gate valves.
- F. NRS gate valves.
- G. Indicator posts.
- H. Trim and drain valves.

**1.2 RELATED REQUIREMENTS**

- A. Section 21 05 00 - Common Work Results for Fire Suppression
- B. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment.
- C. Section 21 13 00 - Fire-Suppression Sprinkler Systems.
- D. Division 22 - Plumbing
- E. Division 23 - HVAC
- F. Division 26 - Electrical
- G. Division 28 - Electronic Safety and Security

**1.3 REFERENCE STANDARDS**

- A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
- C. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300; 2021.
- D. FM (AG) - FM Approval Guide; Current Edition.
- E. FM 1120/1130 - Approval Standard for Fire Service Water Control Valves (OS&Y and NRS Gate Valves); 1997.
- F. FM 1140 - Approval Standard for Quick Opening Valves 1/4 Inch through 2 Inch Nominal Size; 1998.
- G. NFPA 24 - Standard for the Installation of Private Fire Service Mains and their Appurtenances; 2019
- H. NFPA 72 - National Fire Alarm and Signaling Code; 2022

General-Duty Valves for Water-Based Fire-  
Suppression Piping

- I. UL (DIR) - Online Certifications Directory; Current Edition.
- J. UL 258 - Shutoff Valves for Trim and Drain Purposes for Fire Protection Service; Current Edition, Including All Revisions.
- K. UL 262 - Gate Valves for Fire-Protection Service; Current Edition, Including All Revisions.
- L. UL 312 - Check Valves for Fire-Protection Service; Current Edition, Including All Revisions.
- M. UL 789 - Indicator Posts for Fire-Protection Service; Current Edition, Including All Revisions.
- N. UL 1091 - Standard for Butterfly Valves for Fire-Protection Service; Current Edition, Including All Revisions.
- O. California Building Code; 2022
- P. California Fire Code; 2022

#### **1.4 SUBMITTALS**

- A. Contractor to include items listed in product section along with any additional items required to provide a complete and fully functioning installation per NFPA 13 and all adopted building and fire codes.
- B. Product Data: Provide manufacturer's catalog information. Where more than one product or model is available, provide red marking arrows or highlights on the cut sheets to clearly identify the product models, finishes, orientations, and any further clarification needed of the intended products for use, to complete a thorough review.
- C. Review of submittals does not relieve Contractor from coordinating installation of work with other trades, or from compliance with Codes and Standards.
- D. Project Record Documents: Record actual locations of components and tag numbering.
- E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.
- F. Provide Owner with the following:
  - 1. Manufacturer's literature and instructions describing operation and maintenance of equipment and devices installed.
  - 2. Typewritten chart with identification and location of all access panels serving equipment and valves. Incorporate into Operation & Maintenance (O&M) manual.
  - 3. Typewritten valve schedule indicating valve number, fixture/equipment or areas served by each numbered valve. Incorporate into O&M manual.
  - 4. 8-1/2 x 11 laminated flow diagram showing isolation valve locations, drain valve locations, and system boundaries, where applicable, and attach it to the system riser.

General-Duty Valves for Water-Based Fire-  
Suppression Piping

5. Current copy of NFPA 25 – Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

## **1.5 QUALITY ASSURANCE**

- A. Comply with UL (DIR) requirements.
- B. Valves: Bear UL (DIR) product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- C. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.
- D. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to the site under provisions of Division 01
- B. Store and protect products under provisions of Division 01
- C. All materials shall be stored in a clean, dry space.
- D. Promptly inspect shipments to ensure material is undamaged and complies with Specifications. Storage and protection methods must allow inspection to verify products.
- E. Prepare valves for shipping as follows:
  1. Protect internal parts against rust and corrosion.
  2. Protect threads, grooves, and flanged faces.
  3. Set valves open to minimize exposure of functional surfaces.
- F. Deliver and store valves in shipping containers, with labeling in place.
- G. Use the following precautions during storage:
  1. Maintain valve end protection and protect flanges and specialties from dirt.
    - a. Provide temporary inlet and outlet caps.
    - b. Maintain caps in place until installation.
  2. Store valves in shipping containers and maintain in place until installation.
    - a. Store valves indoors and maintain at higher than ambient dew point temperature.
    - b. If outdoor storage is unavoidable, store valves off the ground in watertight enclosures.
- H. Use the following precautions for handling:
  1. Use sling to handle large valves, rig to avoid damage to exposed parts.
  2. Do not use operating handles or stems as lifting or rigging points.
- I. Offsite storage agreements will not relieve Contractor from using proper storage techniques.

## **PART 2 PRODUCTS**

### **2.1 GENERAL REQUIREMENTS**

- A. Valve Pressure Ratings: Not less than 175 psi pressure rated, or higher as required.
- B. Valve Sizes: Same as upstream piping unless otherwise indicated.

### **2.2 BRONZE BALL VALVES WITH INDICATORS**

- A. Manufacturers:
  - 1. Nibco; [www.nibco.com](http://www.nibco.com).
  - 2. Victaulic; [www.victaulic.com](http://www.victaulic.com).
  - 3. Watts; [www.watts.com](http://www.watts.com)
- B. Minimum Pressure Rating: 175 psig.
- C. Body Material: Bronze.
- D. Seat: Chrome plated brass.
- E. Stem: Bronze or stainless steel.
- F. Actuator: Brass travel nut.
- G. Supervisory Switch: Internal or external.

### **2.3 IRON BUTTERFLY VALVES WITH INDICATORS**

- A. Manufacturers:
  - 1. Nibco: [www.nibco.com](http://www.nibco.com).
  - 2. Kennedy; [www.kennedy.com](http://www.kennedy.com)
  - 3. Victaulic; [www.victaulic.com](http://www.victaulic.com)
- B. UL 1091 and FM 1112 listed.
- C. Minimum Pressure Rating: 175 psig.
- D. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
- E. Seat: EPDM.
- F. Stem: Stainless steel.
- G. Disc: Ductile iron with EPDM coating.
- H. Actuator: Worm gear or traveling nut.
- I. Body Design: Grooved-end or wafer style.

### **2.4 SWING CHECK VALVES**

- A. Manufacturers:
  - 1. Kennedy; [www.kennedyvalve.com](http://www.kennedyvalve.com).
  - 2. Nibco; [www.nibco.com](http://www.nibco.com)
  - 3. Victaulic; [www.victaulic.com](http://www.victaulic.com)
- B. UL 312 and FM 1210 listed.

General-Duty Valves for Water-Based Fire-  
Suppression Piping



- C. Minimum Pressure Rating: 175 psig.
- D. Body Material: Cast or ductile iron.
- E. Clapper: Bronze, EPDM-coated ductile iron, or stainless steel.
- F. Seat: Bronze or EPDM-coated bronze.
- G. End Connections: Flanged.

## **2.5 BRONZE OS&Y GATE VALVES**

- A. Manufacturers:
  - 1. Nibco; [www.nibco.com](http://www.nibco.com).
  - 2. Kennedy; [www.kennedy.com](http://www.kennedy.com).
  - 3. Victaulic; [www.victaulic.com](http://www.victaulic.com)
- B. UL 262 and FM 1120/1130 listed.
- C. Minimum Pressure Rating: 175 psig.
- D. Body and Bonnet Material: Bronze or brass.
- E. Wedge: One-piece bronze or brass.
- F. Wedge Seat: Bronze.
- G. Stem: Bronze or brass.
- H. Packing: Non-asbestos PTFE.
- I. End Connections: Threaded, grooved, or flanged.

## **2.6 IRON OS&Y GATE VALVES**

- A. Manufacturers:
  - 1. Kennedy Valve: [www.kennedyvalve.com/#sle](http://www.kennedyvalve.com/#sle).
  - 2. Nibco; [www.nibco.com](http://www.nibco.com).
  - 3. Victaulic; [www.victaulic.com](http://www.victaulic.com)
- B. UL 262 and FM 1120/1130 listed.
- C. Minimum Pressure Rating: 175 psig.
- D. Body and Bonnet Material: Cast or ductile iron.
- E. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
- F. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
- G. Stem: Brass, bronze, or stainless steel.
- H. Packing: Non-asbestos PTFE.
- I. Supervisory Switch: External.

## **2.7 IRON NRS GATE VALVES**

- A. Manufacturers:
  - 1. Kennedy Valve; [www.kennedy.com](http://www.kennedy.com)
  - 2. Nibco; [www.nibco.com](http://www.nibco.com).

- 3. Victaulic; [www.victaulic.com](http://www.victaulic.com)
- B. UL 262 and FM 1120/1130 listed.
- C. Minimum Pressure Rating: 175 psig.
- D. Body and Bonnet Material: Cast or ductile iron.
- E. Wedge: Cast or ductile iron with elastomeric coating.
- F. Stem: Brass or bronze.
- G. Packing: Non-asbestos PTFE.
- H. Operation:
  - 1. Operating nut for post-indicating valves.
  - 2. Handwheel for non-post-indicating valves.
- I. Post Plate: Provide for post-indicating valves.
- J. End Connections: Flanged.

## **2.8 TRIM AND DRAIN VALVES**

- A. Ball Valves:
  - 1. Manufacturers:
    - a. Nibco; [www.nibco.com](http://www.nibco.com).
    - b. Victaulic; [www.victaulic.com](http://www.victaulic.com).
  - 2. Description:
    - a. UL 258 or FM 1140 listed.
    - b. Pressure Rating: 175 psig.
    - c. Body Design: Two piece.
    - d. Body Material: Forged brass or bronze.
    - e. Port Size: Full or standard.
    - f. Seat: PTFE.
    - g. Stem: Bronze or stainless steel.
    - h. Ball: Chrome-plated brass.
    - i. Actuator: Hand-lever.
    - j. End Connections: Threaded or grooved.
- B. Angle Valves:
  - 1. Manufacturers:
    - a. United Brass Works, Inc.; [www.ubw.com](http://www.ubw.com).
    - b. Nibco; [www.nibco.com](http://www.nibco.com).
    - c. Milwaukee; [www.milwaukeevalve.com](http://www.milwaukeevalve.com).
  - 2. Description:
    - a. UL 258 or FM 1140 listed.
    - b. Pressure Rating: 175 psig.
    - c. Body Material: Brass or bronze.
    - d. Ends: Threaded.
    - e. Stem: Bronze.

General-Duty Valves for Water-Based Fire-  
Suppression Piping

- f. Disc: Bronze.
  - g. Packing: Asbestos free.
  - h. Handwheel: Malleable iron, bronze, or aluminum.
- C. Globe Valves:
  - 1. Manufacturers:
    - a. United Brass Works, Inc.; [www.ubw.com](http://www.ubw.com).
    - b. Nibco; [www.nibco.com](http://www.nibco.com).
    - c. Milwaukee; [www.milwaukeevalve.com](http://www.milwaukeevalve.com).
  - 2. Description:
    - a. UL 258 or FM 1140 listed.
    - b. Pressure Rating: 175 psig.
    - c. Body Material: Bronze with integral seat and screw-in bonnet.
    - d. Ends: Threaded.
    - e. Stem: Bronze.
    - f. Disc Holder and Nut: Bronze.
    - g. Disc Seat: Nitrile.
    - h. Packing: Asbestos free.
    - i. Handwheel: Malleable iron, bronze, or aluminum.
- D. Test and Drain Valves:
  - 1. Manufacturers:
    - a. AGF; [www.testandrain.com](http://www.testandrain.com)
    - b. Globe; [www.globesprinkler.com](http://www.globesprinkler.com)
    - c. Victaulic; [www.victaulic.com](http://www.victaulic.com)
  - 2. Description:
    - a. Pressure Rated: 300 psig
    - b. Body Material: Brass or bronze
    - c. Ends: Threaded
    - d. Attachments: With pressure relief valve set to operate at 175 psi or 10 psi above system working pressure, whichever is greater.
    - e. Orifice: smallest size of sprinkler K-factor
- E. Air Release Valves:
  - 1. Manufacturers:
    - a. Engineered Corrosion Solutions
    - b. Potter Electric
    - c. AGF Manufacturing
  - 2. Description:
    - a. Automatic float type air vent
    - b. UL listed, FM approved "Automatic Air release Valve for Sprinkler Systems"
    - c. Rated to 175 psi water working pressure

3. Valve shall be installed in an accessible location to permit operation, maintenance, and visual inspection of the status of the valve.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Confirm valve interior to be free of foreign matter and corrosion.
- B. Remove packing materials.
- C. Examine guides and seats by operating valves from the fully open position to the fully closed position.
- D. Examine valve threads and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage.
  1. Check bolting for proper size, length, and material.
  2. Verify gasket for size, defects, damage, and suitable material composition for service.
  3. Replace defective valves with new valves.

#### **3.2 INSTALLATION**

- A. Install valves in accessible locations to allow for operation, inspections, tests, and maintenance.
- B. Install listed valves in accordance with their listing.
- C. Install valves in accordance with manufacturer's instructions.
- D. Support valves independently of adjacent piping.
- E. Install valves in horizontal piping with stem at or above pipe center.
- F. Position valves to allow full actuator movement.
- G. Install OS&Y valves with full clearance for rising stem. Install surrounding components so they do not interfere with nor are they impacted by full extension of rising stem.
- H. Install permanent identification signs indicating portion of system controlled by each shutoff valve.
- I. Install threaded-end valves with unions upstream and downstream.
- J. Install valve tags. See Section 21 05 53. Label valves in accordance with NFPA standard applying to the piping system in which valves are installed.

**END OF SECTION**

General-Duty Valves for Water-Based Fire-  
Suppression Piping

**SECTION 21 05 53**  
**IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe markers.

**1.2 RELATED REQUIREMENTS**

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. Section 09 91 23 - Interior Painting: Stencil paint.

**1.3 REFERENCE STANDARDS**

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

**1.4 SUBMITTALS**

- A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- B. Product Data: Provide manufacturers catalog literature for each product required.
- C. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.
- D. Project Record Documents: Record actual locations of tagged valves.

**PART 2 PRODUCTS**

**2.1 IDENTIFICATION APPLICATIONS**

- A. Control Panels: Nameplates.
- B. Piping: Pipe markers.
- C. Valves: Nameplates.

**2.2 MANUFACTURERS**

- A. Brady Corporation: [www.bradyid.com](http://www.bradyid.com).
- B. Champion America, Inc: [www.Champion-America.com](http://www.Champion-America.com).
- C. Seton Identification Products: [www.seton.com/aec](http://www.seton.com/aec).

**2.3 NAMEPLATES**

- A. Manufacturers:
  - 1. Brimar Industries, Inc: [www.pipemarker.com/#sle](http://www.pipemarker.com/#sle).

Identification for Fire Suppression Piping  
and Equipment  
21 05 53 - 1

2. Kolbi Pipe Marker Company: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).
  3. Seton Identification Products, a Tricor Direct Company: [www.seton.com/#sle](http://www.seton.com/#sle).
- B. Description: Laminated three-layer plastic with engraved letters.
1. Letter Color: White.
  2. Letter Height: Equipment, control panels 1 inch.
  3. Letter Height: Controls and small components, 1/4 inch.
  4. Background Color: Red.

## **2.4 TAGS**

- A. Manufacturers:
1. Advanced Graphic Engraving, LLC: [www.advancedgraphicengraving.com/#sle](http://www.advancedgraphicengraving.com/#sle).
  2. Brady Corporation: [www.bradycorp.com/#sle](http://www.bradycorp.com/#sle).
  3. Brimar Industries, Inc: [www.pipemarkers.com/#sle](http://www.pipemarkers.com/#sle).
  4. Craftmark Pipe Markers: [www.craftmarkid.com/#sle](http://www.craftmarkid.com/#sle).
  5. Kolbi Pipe Marker Company: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).
  6. Seton Identification Products, a Tricor Direct Company: [www.seton.com/#sle](http://www.seton.com/#sle).
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

## **2.5 STENCILS**

- A. Manufacturers:
1. Brady Corporation; \_\_\_\_\_: [www.bradycorp.com/#sle](http://www.bradycorp.com/#sle).
  2. Craftmark Pipe Markers; \_\_\_\_\_: [www.craftmarkid.com/#sle](http://www.craftmarkid.com/#sle).
  3. Insite Solutions, LLC; \_\_\_\_\_: [www.stop-painting.com/#sle](http://www.stop-painting.com/#sle).
  4. Kolbi Pipe Marker Co; \_\_\_\_\_: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).
  5. Seton Identification Products, a Tricor Direct Company; \_\_\_\_\_: [www.seton.com/#sle](http://www.seton.com/#sle).
- B. Stencils: With clean cut symbols and letters of following size:
1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
  2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
  3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
  4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.

## **2.6 PIPE MARKERS**

- A. Manufacturers:
1. Brady Corporation: [www.bradycorp.com/#sle](http://www.bradycorp.com/#sle).

2. Brimar Industries, Inc: [www.pipemarker.com/#sle](http://www.pipemarker.com/#sle).
  3. Craftmark Pipe Markers: [www.craftmarkid.com/#sle](http://www.craftmarkid.com/#sle).
  4. Kolbi Pipe Marker Company: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).
  5. Seton Identification Products, a Tricor Company: [www.seton.com/#sle](http://www.seton.com/#sle).
- B. Color: Comply with ASME A13.1.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Secure to pipe using two (2) bands of adhesive tape with flow arrows supplied by the manufacturer. Install securing bands completely around pipe and overlapped.
- E. Underground Plastic Pipe Markers: Bright-colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

### **PART 3 EXECUTION**

#### **3.1 PREPARATION**

- A. Degrease and clean surfaces to receive adhesive for identification materials.

#### **3.2 INSTALLATION**

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Identify valves in main and branch piping with tags.
- G. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service and flow direction. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

#### **END OF SECTION**

**SECTION 21 13 00**  
**FIRE-SUPPRESSION SPRINKLER SYSTEMS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Wet-pipe sprinkler system.
- B. System design, installation, and certification.

**1.2 RELATED REQUIREMENTS**

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. Section 21 05 00 - Common Work Results for Fire Suppression: Pipe and fittings.
- C. Section 21 05 23 - General-Duty Valves for Water-Based Fire-Suppression Piping.
- D. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment.
- E. Division 22 - Plumbing
- F. Division 23 - HVAC
- G. Division 26 - Electrical
- H. Division 28 - Electronic Safety and Security

**1.3 REFERENCE STANDARDS**

- A. NFPA 13 - Standard for the Installation of Sprinkler Systems: 2022.
- B. UL (DIR) - Online Certifications Directory; Current Edition.

**1.4 SUBMITTALS**

- A. Contractor to include items listed in product section along with any additional items required to provide a complete and fully functioning installation per NFPA 13 and all adopted building and fire codes.
- B. Product Data: Provide manufacturer's catalog information. Where more than one product or model is available, provide red marking arrows or highlights on the cut sheets to clearly identify the product models, finishes, orientations, and any further clarification needed of the intended products for use, to complete a thorough review. Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections, and accessories.
- C. Shop Drawings: Fire sprinkler system design is not a deferred submittal.
  - 1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.



2. Indicate hydraulic calculation placards, detailed pipe layout, hangers and supports, sprinklers, seismic details and calculations, components and accessories. Indicate system controls.
  3. Submit shop drawings to LP Engineers for approval.
    - a. Engineer's drawings are not contractors coordinated shop or installation drawings and cannot be used for contractors submittal.
  4. Installation is to conform to approved fire sprinkler plans.
  5. Approved documents do not relieve the contractor of field coordination. It is the fire sprinkler contractors' responsibility to coordinate piping locations with the work of other trades.
  6. Preparation of installation and fabrication drawings is the responsibility of the fire sprinkler contractor.
- D. Material Data: Approved material data is a guideline. The fire sprinkler system design parameters must be strictly adhered to. Alternate manufacturers may be submitted to LP Consulting Engineers, Inc. for review of project compliance. A copy of the approved material data must be on the project site for the Project Inspector prior to the commencement of installation.
- E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
- F. Operation and Maintenance Data: Include components of system, servicing requirements, record as-built drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
  2. Sprinkler Wrenches: For each sprinkler type.
- H. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.
- I. Provide Owner with the following;
1. Manufacturer's literature and instructions describing operation and maintenance of equipment and devices installed.
  2. Typewritten chart with identification and location of all access panels serving equipment and valves. Incorporate into Operation & Maintenance (O&M) manual.
  3. Typewritten valve schedule indicating valve number, fixture/equipment or areas served by each numbered valve. Incorporate into O&M manual.
  4. 8-1/2 x 11 laminated flow diagram showing isolation valve locations, drain valve locations, and system boundaries, where applicable, and attach it to the system riser.
  5. Final contractor corrected As-Built of completed installation.
  6. Current copy of NFPA 25 – Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

## **1.5 QUALITY ASSURANCE**

- A. Maintain one copy of referenced design and installation standard on site.
- B. Conform to UL and/or FM requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- D. Fabrication shop must provide welding certifications and copy of weld stamp. Weld stamp to be provided on all pipe at welds.
- E. Contractor Qualifications: Provide licensed persons employed by sprinkler contractor to perform planning, calculations, layout, installation, and testing of fire protection systems. The following are acceptable:
  - 1. Licensed Professional Engineer
  - 2. National Institute for Certification of Engineering Technologies (NICET) Level III
  - 3. Certified sprinkler designer
- F. Installer Qualifications: Company specializing in performing the work of this section. with minimum five years experience approved by manufacturer.
  - 1. Contractor shall be licensed in the State of California for installation of fire protection systems.
  - 2. Installing company must have a valid State of California contractors' license with a C-16 classification.
- G. Equipment and Components: Provide products that bear UL and FM label or marking.
- H. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

## **1.6 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS**

- A. Fire protection systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.
- B. Fire protection systems and equipment shall include, but are not limited to, all piping, valve assemblies, fire pumps, electrical and control panels, conduits and other components.
- C. For all non-standard installations not detailed in one of the approved systems, the Contractor shall provide details of supports, anchorages and restraints, including attachments to building structure, with supporting calculations all stamped and signed by a licensed professional structural engineer registered in the State of California.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

- B. Reference specification 21 0500 - Common Work Results for Fire Suppression section 1.06 for additional information.

**PART 2 PRODUCTS - ALL PRODUCTS SHALL CONFORM TO CONTRACT DOCUMENTS INCLUDING APPROVED MATERIAL DATA.**

**2.1 SPRINKLER SYSTEM**

- A. Sprinkler System: Provide coverage for building areas noted on drawings, including all areas, rooms, spaces above and below ceilings, entry ways, overhangs (if applicable), and all other areas requiring sprinkler protection in accordance with NFPA 13.
- B. Occupancy: Office spaces, Corridors, Bathrooms, Classrooms, Dining Areas, and common spaces - Light Hazard.
- C. Occupancy: Electrical and IT rooms, Janitor closets, Mechanical rooms, Linen closets, Kitchens, and Storage areas not exceeding shelving 8ft in height - Ordinary Hazard Group 1.
- D. Occupancy: Chemistry and Lab Classrooms, Pharmacy, and Storage areas with storage not greater than 12ft in height - Ordinary Hazard Group 2.
- E. Interface system(s) with building fire and smoke alarm system.
- F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to fire sprinkler riser. Supply no less than two (2) spare sprinklers of each type and temperature rating used on project. Storage cabinet to include a wrench(s) applicable to sprinkler types.

**2.2 SPRINKLERS**

- A. Finished Ceiling Type: Concealed pendant type with matching screw on escutcheon plate.
  - 1. Response Type: Quick.
  - 2. Coverage Type: Standard.
  - 3. Finish: Brass.
  - 4. Cover Plate Finish: White.
  - 5. Fusible Link: Glass bulb type temperature rated for specific area hazard.
  - 6. Manufacturers:
    - a. Tyco Fire Protection Products: [www.tyco-fire.com/#sle](http://www.tyco-fire.com/#sle).
    - b. Viking; [vikinggroupinc.com](http://vikinggroupinc.com).
  - 7. Application: All finished ceilings
  - 8. Installed with side takoffs or on return bends with hard pipe or when permitted, with flexible sprinkler drops
- B. Exposed Area Type: Pendant or Upright.
  - 1. Response Type: Quick.
  - 2. Coverage Type: Standard.
  - 3. Finish: Brass.
  - 4. Fusible Link: Glass bulb type temperature rated for specific area hazard.
  - 5. Manufacturers:

- a. Tyco Fire Protection Products; [www.tyco-fire.com](http://www.tyco-fire.com)
  - b. Viking; [vikinggroupinc.com](http://vikinggroupinc.com).
- 6. Application: Areas with exposed construction unless noted otherwise
- C. Guards: chrome plated with style and listing to match the sprinkler head type used.
- D. Flexible Drop System: Flexible Hose Assembly and End Fittings.
  - 1. Composition: 100% Type 304/316 Stainless Steel
  - 2. Shall be leak-tested with minimum 1" true-bore internal corrugated hose diameter
  - 3. Straight Hose Assembly
  - 4. Elbow Hose Assembly
  - 5. Provide braided type tube not exceeding 4ft lengths as required for the application.
  - 6. Types acceptable that do not exceed the equivalent length of 28.7ft for 5.6k heads and 30.5ft for 8.0k heads. Equivalent lengths less than or equal to that are acceptable for use.
  - 7. Manufacturers:
    - a. FlexHead Industries Model 20XXT; [www.asc-es.com](http://www.asc-es.com).
    - b. Victaulic Company Model AH2; Vic-Flex: [www.victaulic.com/#sle](http://www.victaulic.com/#sle).
    - c. SuperFlex Model 20XXSF; [www.asc-es.com](http://www.asc-es.com).

## **2.3 PIPING SPECIALTIES**

- A. Zone Control Valves
  - 1. Outside screw and yoke or butterfly, U.L. listed.
  - 2. Valves shall be sealed open using approved seal.
  - 3. Provide weatherproof actuator housing with two single pole double throw switches.

## **2.4 ALARM BELL**

- A. Waterflow alarm shall be included at building riser. Waterflow alarm shall be compatible with building's fire alarm system, be rated for exterior use, and be located outside fire riser or above FDC, if one is provided on exterior wall.
  - 1. A 6" alarm bell shall be used.

# **PART 3 EXECUTION**

## **3.1 INSTALLATION**

- A. Install in accordance with referenced NFPA design and installation standards and adopted fire codes.
  - 1. DSA requirements and DSA approved plans.
- B. Approved documents do not relieve the fire sprinkler contractor of field coordination. It is the fire sprinkler contractors' responsibility to coordinate piping locations with the work of other trades.
- C. Strict adherence to the contract design documents is required. Any deviation from the contract documents requiring additional plan review, hydraulic

calculations, structural review or calculations, or seismic calculations, shall be submitted to LP Consulting Engineers, Inc. for review prior to making changes. LP Consulting Engineers, Inc. to provide calculations and updated plans for DSA approval.

- D. Install equipment in accordance with manufacturer's instructions.
- E. Preparation of installation and fabrication drawings is the responsibility of the fire sprinkler contractor.
- F. Systems that are hydraulically calculated include 1.2 factor for design area.
- G. Hydraulically calculated system are designed to a minimum of 10% below the available water flow curve.
- H. Fire Protection System Layout and Installation Drawings:
  - 1. Contractor shall review Design Drawings and Specifications, and shall provide coordinated installation drawings and product data sheets.
  - 2. Layout of fire protection system has been established for the level shown in contract documents, as it relates to structure, and mechanical/electrical systems in building, and must be adhered to. Other layouts shall be produced by Contractor in coordination with building components.
  - 3. Conceal sprinkler piping above ceilings where possible.
  - 4. Contractor shall consult with Architect during development of piping layout to avoid conflicts with general appearance. Pipe routing is a critical issue due to attributes of this building.
  - 5. Contractor shall be responsible to have examined "Reflected Ceiling" drawings as well as Mechanical, Electrical, Piping, Information Technology, Structural and Architectural building plans prior to system layout.
  - 6. Contractor shall coordinate routing of piping with other trades and Architect.
  - 7. Contractor shall participate in coordination process and shall not install piping prior to coordination with other trades.
- I. Locate outside alarm on building wall as indicated on Fire Sprinkler Shop Drawings.
- J. Place pipe runs to minimize obstruction to other work.
- K. Place piping in concealed spaces above finished ceilings.
- L. Where pipe is exposed to outside elements, provide galvanized pipe, fittings, and hangers.
- M. Threaded pipe where exposed threads are present outside, shall be coated with a corrosion resistant paint equal to Rust-Oleum.
  - 1. See specification 21 05 00 for reference.
- N. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

- O. All drops to sprinkler heads in finished ceilings shall be side or top takeoffs from the branch line pipe and shall be centered in ceiling tiles using hard pipe connections or when approved, with flexible sprinkler drops.
    - 1. No bottom takeoffs other than pendent sprinkler heads attaching directly to branchline pipes, shall be permitted.
  - P. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
  - Q. Flush entire piping system of foreign matter.
  - R. Install head guards on sprinklers where indicated on the drawing in addition to the following areas:
    - 1. All electrical and IT rooms without ceilings shall be provided with head guards.
    - 2. Sprinkler heads below obstructions in all mechanical spaces shall be provided with head guards.
  - S. Hydrostatically test entire system.
  - T. Required test to be witnessed by Fire Marshal.
  - U. Verification of weld inspection required prior to installation of fire sprinkler system.
- 3.2 INTERFACE WITH OTHER PRODUCTS**
- A. Ensure required devices are installed and connected as required to fire alarm system.

**END OF SECTION**

**SECTION 22 05 10  
PLUMBING GENERAL PROVISIONS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. References.
- B. Description of Work.
- C. Drawings and Specifications.
- D. Industry Standards and Codes.
- E. Site Examination.
- F. Permits, Fees and Utility Connections.
- G. Coordination of Work.
- H. Progress of Work.
- I. Submittals
- J. Operation and Maintenance Manuals.
- K. Project Record Documents.
- L. Warranty.
- M. Quality and Care
- N. Access Doors.
- O. Starting Equipment and Systems.

**1.2 RELATED SECTIONS**

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 22.

**1.3 REFERENCES**

- A. ANSI - American National Standards Institute.
- B. ASTM - American Society for Testing Materials.
- C. CEC - California Electric Code.
- D. NEMA - National Electric Manufacturers' Association.
- E. NFPA - National Fire Protection Association.
- F. OSHA - Occupational Safety and Health Act.
- G. UL - Underwriters' Laboratories.

- H. See detailed References that are listed in individual sections.

#### **1.4 DESCRIPTION OF WORK**

- A. The work included in this division of the specifications consists of furnishing labor, tools, equipment, supplies and materials, unless otherwise specified, and in performing operations necessary for the installation of the complete Plumbing System as required by these specifications or shown on the Drawings, subject to the terms and conditions of the Contract Agreement.
- B. The work shall also include the completion of details of plumbing work not mentioned or shown which are necessary for the successful operation of mechanical systems described on the drawings or required by these specifications. Furnish and install any incidental work not shown or specified which is required to provide a complete and operational system.

#### **1.5 DRAWINGS AND SPECIFICATIONS**

- A. Drawings are schematic and diagrammatic. Drawings indicate the general arrangement of equipment, piping, and other plumbing work. Use judgement and care to install mechanical work to fit the job conditions within the building construction and finishes, and to function properly.
- B. The Contractor shall investigate the building conditions affecting the Work and shall arrange his work accordingly providing offsets, fittings, valves and accessories to fit the actual job conditions. The Contractor shall be responsible to field measure and confirm new and existing mechanical systems locations with respect to other architectural, structural, and electrical work, existing and new. Do not scale distances off of the mechanical drawings. Use actual building dimensions.
- C. The drawings and specifications are complimentary each to the other. What is required by one shall be as binding as if called for by both.
- D. Examine all drawings and specifications prior to bidding the Work. Report any discrepancies to the Engineer.

#### **1.6 INDUSTRY STANDARDS AND CODES**

- A. The Mechanical Contractor shall comply with the latest provisions of all codes, regulations, laws and ordinances applicable to the work involved. This does not relieve the Contractor from furnishing and installing work shown or specified which may exceed the requirements of such codes, regulations laws and ordinances.
- B. All materials, products, devices, fixtures forms or types of construction included in this project shall meet or exceed the published requirements of the publications listed below. These publications form a part of this specification.
  - 1. California Building Code, 2022.
  - 2. California Mechanical Code, 2022.
  - 3. California Plumbing Code, 2022.
  - 4. California Electrical Code, 2022.
  - 5. National Fire Protection Association.



6. California Fire Code, 2022.
  7. California State Fire Marshal.
  8. Occupational Safety and Health Administration, including CAL-OSHA.
  9. California Energy Code, 2022.
  10. California Green Building Standards Code, 2022.
  11. State of California Code of Regulations, Title 24.
  12. Other applicable state laws.
- C. Nothing in the Drawings or Specifications shall be construed to permit work that does not conform these codes. When Contract Documents differ from governing codes, furnish and install to the higher standard required at no extra charge. The Contract Documents are not intended to repeat the code requirements except where necessary for clarity.
- D. No material or product installed as a part of the Work shall contain asbestos in any form.
- E. Domestic water piping and components shall be provided and installed in accordance with California AB 1953 Legislation (effective January 1, 2010), which limits the allowable lead content in certain domestic water system components.

#### **1.7 SITE EXAMINATION**

- A. Contractor shall examine the site, verify dimensions and locations with Drawings, check utility connection locations, and familiarize himself with the existing conditions and limitations. No extras will be allowed because of the Contractor's misunderstanding of the amount of work involved or his lack of knowledge of any site condition which may affect his work. Any apparent variance of the drawings or specifications from the existing conditions at the site shall be called to the attention of the Engineer immediately.

#### **1.8 PERMITS, FEES AND UTILITY SERVICES**

- A. Contractor shall pay for and obtain all permits and service required in the installation of this work.
- B. Contractor shall arrange for all required inspections and will secure approvals from authorities having jurisdiction.

#### **1.9 COORDINATION OF WORK**

- A. It is recognized that the contract documents are diagrammatic in showing certain physical relationships which must be established within the mechanical work, and in its interface with other work and that such establishment is the exclusive responsibility of the contractor.
- B. The Contractor shall give careful consideration to the work of the General, Electrical and other contractors on the job and shall organize his work so that it will not interfere with the work of other trades. He shall consult the drawings and specifications for work of other trades for correcting information, and the pertinent drawings for details and dimensions.

- C. Arrange plumbing work in a neat, well-organized manner with the piping and similar services running parallel and/or perpendicular to primary lines of the building construction. Locate operating and control equipment properly to provide easy access, and arrange entire mechanical work with adequate access for operation and maintenance.
- D. Verify the location of all equipment, plumbing devices, etc. and if interference develops, the Owner/Engineer's decision will be final and no additional compensation will be allowed for the moving of misplaced air devices or equipment.

#### **1.10 PROGRESS OF WORK**

- A. This Contractor shall organize his work so that the progress of the mechanical work will conform to the progress of the other trades, and shall complete the entire installation as soon as the conditions of the building will permit. Any cost resulting from defective or ill timed work performed under this section shall be borne by this Contractor.

#### **1.11 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS**

- A. Plumbing systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.
- B. Plumbing systems and equipment shall include, but are not limited to, all piping, water heaters, expansion tanks, air compressors, vacuum pumps, electrical and control panels, conduits and other components.
- C. For all non-standard installations not detailed in one of the approved systems, the Contractor shall provide details of supports, anchorages and restraints, including attachments to building structure, with supporting calculations all stamped and signed by a licensed professional structural engineer registered in the state in which the Work is performed.

#### **1.12 SUBMITTALS**

- A. See Division 1 for additional submittal procedures.
- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project.
- D. Organize submittals in sequence according to Specification Section. Submit in bound document with tabs identifying each Specification Section. Provide a Table of Contents identifying the Specifications Sections being submitted and the contents within each tabbed section. Prepare Submittals in multiple volumes if required. Provide a complete Submittal package at one time. Do not submit individual Sections piecemeal.
- E. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

- F. Furnish, upon request, installation instructions for all equipment and materials to Inspector of Record prior to installation.
- G. Maintain a copy of the fire penetration installation instructions on site for use by the Inspector of Record.

### **1.13 SUBSTITUTION PROCEDURES**

- A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
- B. LP Consulting Engineers, Inc. will consider requests for substitutions only within 7 days after date of Agreement.
- C. Substitutions may be considered when a product becomes unavailable through no fault of the .
- D. Failure by the Contractor to order materials or equipment in a timely manner will not constitute justification for a substitution.
- E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- F. A request for substitution constitutes a representation that the submitter:
  - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
  - 2. Will provide the same warranty for the substitution as for the specified product.
  - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
  - 5. Will reimburse Owner and LP Consulting Engineers, Inc. for review or redesign services associated with reapproval by authorities including obtaining reapproval by authorities.
- G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- H. If excessive review, as judged by the Engineer, is required caused by complicated, numerous or repetitive requests, Contractor shall reimburse Engineer and its Consultants for such review at their standard billing rates.
- I. Substitution Submittal Procedure:
  - 1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
  - 2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
  - 3. The LP Consulting Engineers, Inc. will notify in writing of decision to accept or reject request.

4. Present each substitution individually. If a proposed substitute is not found to be acceptable, then the specified item shall be supplied.

#### **1.14 OPERATION AND MAINTENANCE MANUALS**

- A. See Division 1 for Closeout Submittals for Operation and Maintenance Manual requirements.
- B. Provide operating and maintenance instructions, diagrams and parts lists for all components of all mechanical systems and each piece of equipment furnished under these specifications.
- C. Operating and maintenance instructions shall be furnished for the following equipment and systems:
  1. Plumbing Systems.
  2. Medical Gas Equipment, Piping and Alarm Systems.
  3. Piping Systems.
  4. Temperature Controls Systems.
  5. Testing, Adjusting, and Balancing Reports.
- D. Provide manufacturer's model number, design data, capacities, etc. for each piece of plumbing equipment furnished as a part of the Work.
- E. The operating instructions shall include procedures for starting, stopping and emergency manual operation for all equipment and systems.
- F. Provide maintenance instructions of each item of individual equipment including applicable maintenance data as recommended by the manufacturer, including frequency of lubrication, lubricants, inspections required, adjustment procedures, belt and pulley sizes, etc.
- G. Provide manufacturer's parts bulletins with part numbers for each item of equipment included in the Work. Parts bulletins shall be specific to the equipment provided. Extraneous information that does not apply to the equipment provided shall be eliminated from the literature.
- H. Include copies of test reports (startup, check, etc.) and inspections performed for each piece of equipment provided in the Work.
- I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- J. Provide supplier and manufacturer contacts, telephone numbers and addresses in the front portion of the operation and maintenance manual.

#### **1.15 PROJECT RECORD DOCUMENTS**

- A. See Division 1 for Closeout Procedures.
- B. Provide red-lined drawings accurately showing location of equipment and devices and size and routing of piping. Include notes explaining installed condition for complete understanding.

#### **1.16 QUALITY ASSURANCE**

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from LP Consulting Engineers, Inc. before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

#### **1.17 PROJECT CONDITIONS**

- A. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

#### **1.18 WARRANTY**

- A. See Division 1 for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.

### **PART 2 PRODUCTS**

#### **2.1 QUALITY AND CARE**

- A. All materials shall be new and in perfect condition when installed unless specifically indicated otherwise. Materials shall be tested within the Continental United States by an independent, nationally recognized testing agency and shall be listed in accordance with testing agency requirements. When not otherwise specified, all material shall conform to applicable National Standards (ANSI).
- B. All capacities, sizes and efficiency ratings shown on the drawing are minimum. Gas meter and gas pressure reducing valve capacities are maximum allowable.
- C. Each category of material or equipment shall be of the same brand or manufacturer throughout the Work wherever possible.
- D. The quality of materials and equipment to be provided is defined by the brand names, manufacturers, model and catalog numbers listed on the Drawings and in the Specifications. Contractor shall provide each item listed, of the quality specified, or equal.

- E. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.
- F. Inspect and report concealed damage to carrier within their required time period.
- G. Store materials in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect from dirt, water, construction debris, and traffic.
- H. Equipment which has been damaged, exposed to weather or is, in the opinion of the Engineer or Owner, otherwise unsuitable because of improper fabrication, storage or installation shall be removed and replaced by this Contractor at his expense.

## **2.2 ACCESS DOORS**

- A. Coordinate access door requirements with Division 1. The more stringent requirements shall govern.
- B. Provide access doors where access through floors, walls or ceilings is required to access plumbing equipment and plumbing devices or other systems requiring access for maintenance, test or observation.
  - 1. Access doors requiring hand access or access for observation only shall be 14"x14" minimum usable opening.
  - 2. Access doors where entrance of a service person may be required shall be 24"x30" minimum usable opening.
- C. Established standard: Milcor of types listed below. Other acceptable manufacturers: Cesco, J.L. Industries, Karp, Larsen's, or equal. Comply with the following:
  - 1. Form doors and frames of welded, ground smooth steel construction, 14 gauge for doors, 16 gauge for frames. Provide prime coat finish except for stainless steel type.
  - 2. Concealed hinges to allow 175 degree opening.
  - 3. Locks: flush, screw driver operated cam lock(s).
  - 4. Provide anchoring devices suitable for the construction into which the doors are framed.
- D. Application (as applicable):
  - 1. In gypsum drywall walls and ceilings: Type DW.
  - 2. In ceramic tile walls: Type MS (stainless steel).
  - 3. In restroom walls: Type MS (stainless steel with satin finish).
  - 4. In fire rated walls: Type Fire Rated (rating as required for wall or ceiling), self closing, 250 F in 30 min. temperature rating.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Access Doors

1. Coordinate the exact location of access doors to provide proper access to the item concealed. Obtain written approval for access door locations from Architect.
2. Coordinate installation of access doors with the trades performing the construction assemblies into which the access doors are placed.
3. Install all access doors neatly and securely, to open and close completely, and to operate freely and without binding. Install rated doors in accordance with their listing requirements.
4. Test operate all doors and make all adjustments required for satisfactory operation. Replace all damaged materials.
5. Install in accordance with manufacturer's instructions.

### **3.2 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with the requirements within this section.
- B. Test all piping with no leak or loss in pressure in accordance with the requirements within this section.

### **3.3 GENERAL TESTING REQUIREMENTS FOR MECHANICAL AND PLUMBING SYSTEMS**

- A. Contractor shall assign a responsible person to be an independent representative to witness testing and to sign as witness of times, pressure and losses of testing media for all hydronic, duct and gas piping testing.
  1. Test all piping as noted below with no leak or loss of pressure. Repair or replace defective piping until tests are accomplished successfully.
  2. Submit to the Engineer for review a log of all tests made which shall include time, temperature, pressure, water makeup and other applicable readings, necessary to indicate the systems have been operated and tested in the manner outlined in the construction documents.
  3. After producing the specified test pressure, disconnect the pressurizing source; do not introduce further pressure for the duration of the test period, repair leaky piping and retest. Repeat the procedure until the entire system is proven tight.
- B. Test the following systems with the medium listed to the pressure indicated for the time period listed:
  1. Sanitary Sewer, Drain, Vent Piping: Pressure=10 Ft.Hd. / Medium= Water / Duration=4 Hours.
  2. Domestic Water Piping: Pressure=125 Psig / Medium= Water / Duration=4 Hours.
  3. Condensate drains: Pressure=10 Ft.Hd. / Medium=Water / Duration=4 Hours.
  4. Gas Piping: Pressure=60 Psig / Medium=Air and soap / Duration=8 Hours.

### **3.4 CUTTING AND PATCHING**

- A. Submit written request in advance of cutting or alteration which affects:
  - 1. Structural integrity of any element of Project.
  - 2. Integrity of weather exposed or moisture resistant element.
  - 3. Efficiency, maintenance, or safety of any operational element.
  - 4. Visual qualities of sight exposed elements.
  - 5. Work of Owner or separate Contractor.
- B. Execute cutting and patching to complete the work, to uncover work to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit Products together to integrate with other work.
- C. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- E. Restore work with new Products in accordance with requirements of Contract Documents.
- F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Code requirements, to full thickness of the penetrated element.
- H. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

### **3.5 PRIMING AND PAINTING**

- A. Apply primer to all exposed ferrous metals that are not factory primed, factory finished, galvanized, stainless steel or anodized. Exposed black steel piping shall be primed and finish painted, including gas piping outdoors.
  - 1. Primer shall be as recommended by the paint manufacturer for each specific application.
  - 2. Acceptable Products include: Fuller O'Brien Blox-Rust Metal All Purpose Primer, equivalent Rust-Oleum product, or equal. See Section 09900 for other acceptable products.
- B. Apply two coats of primer to metal surfaces of items to be insulated or jacketed, except piping, or factory primed or finished.
- C. Preparation:
  - 1. Do not start work until surfaces to be finished are in proper condition to produce finished surfaces of uniform, satisfactory appearance.



2. Stains and Marks: Remove completely, if possible, using materials and methods recommended by coating manufacturer; seal stains and marks which cannot be completely removed using Devoe KILSTAIN primers, shellac, or other coating acceptable to paint manufacturer any marks or defects that might bleed through paint finishes.
  3. Remove mildew from impervious surfaces by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow substrate to thoroughly dry.
  4. Galvanized Surfaces:
    - a. Remove surface contamination and oils by solvent cleaning in accordance with SSPC-SP 1 and allow to dry.
    - b. Apply Devoe MIRROLAC Galvanized Metal Primer in accordance with manufacturer instructions.
  5. Uncoated Steel And Iron Surfaces:
    - a. Remove grease, rust, scale, and dust from steel and iron surfaces using solvent in accordance with SSPC-SP 1.
    - b. Where heavy coatings of scale or contaminants are evident, hand tool clean in accordance with SSPC-SP 2 or use other approved SSPC SP method as needed.
  6. Shop Primed Steel Surfaces: Remove loose primer and dust. Sand and feather edges to smooth surface. Clean areas with solvent and spot prime bare metal surfaces with appropriate Devoe MIRROLAC metal primer or primer recommended by manufacturer.
- D. Application:
1. Apply each coat to uniform coating thickness in accordance with manufacturer's instructions, not exceeding manufacturer's specified maximum spread rate for indicated surface; thins, brush marks, roller marks, orange-peel, or other application imperfections are not permitted.
  2. Allow manufacturer's specified drying time, and ensure correct coating adhesion, for each coat before applying next coat.
  3. Remove dust and other foreign materials from substrate immediately prior to applying each coat.

### **3.6 STARTING EQUIPMENT AND SYSTEMS/COMMISSIONING**

- A. Start equipment and systems in accordance with manufacturer's written instructions..
- B. Adjust for proper operation within manufacturer's published tolerances.
- C. Demonstrate proper operation of equipment to Owner's designated representative.
- D. Description:
  1. Comply with all start up of mechanical and electrical equipment systems as required in the various sections and herein.

2. Coordinate all testing and startup procedures with all other trades so that all non-plumbing and non-electrical work is completed and operational so that the specified testing can be performed.
- E. Preliminary Work:
1. Prior to the startup, the Contractor shall ensure that the systems are ready to operate, and the following items have been completed and checked including but not limited to:
    - a. Proper motor and fan/pump rotation.
    - b. Flushing and cleaning of the system.
    - c. Wiring
    - d. Auxiliary connections
    - e. Lubrication.
    - f. Venting.
    - g. Controls.
    - h. Installation of filters and strainers.
    - i. Setting of relief and safety valves .
  2. All electrical testing must be completed and test results submitted before equipment startup to avoid power interruptions during mechanical equipment startup and testing.
  3. The Contractor shall submit at least 30 days in advance a schedule listing the date of completion of his work as it will be ready for equipment startup of Electrical/Plumbing equipment. This schedule shall include work on a system by system, floor by floor basis.
  4. Two weeks prior to the startup of any major equipment, the Contractor shall certify in writing that the systems will be complete and ready for startup. Completeness shall not only include physical installation of individual pieces of equipment, but all related elements of other crafts to make all equipment operate as a system.
    - a. The startup checklist will cover all related crafts, e.g., controls, electrical, plumbing, and a clean environment for equipment startup.
  5. The Contractor shall schedule a tour with the Owner's representative and the Engineer to review startup conditions prior to equipment startup. This tour shall take place during the associated Engineer's regularly scheduled visit. This tour does not relieve the Contractor of any responsibilities to properly start equipment. The Engineer will issue a notice of deficiencies that will be required to be corrected prior to equipment startup. The Contractor will be required to reschedule a back check with the Engineer prior to attempting an equipment startup.
  6. Equipment of systems should not be started until systems and associated subsystems are completed. Verify that other continuing work could not possibly damage completed systems if they are in operation. Furnish signed off prestartup check sheet.
- F. Startup and Commissioning:
1. System Startup and Operation:

- a. The Contractor shall provide all labor, materials and services necessary for the initial startup and operation of all systems and equipment furnished and installed under this section.
- b. The Contractor and the factory representative shall check all equipment during initial startup to insure correct rotation, proper lubrication, adequate fluids or air flows, nonoverloading electrical characteristics, proper alignment and vibration isolation. Systems shall be checked for water flows throughout without blockages. Plumbing systems shall be checked for proper connections and positions, nonexcessive electrical characteristics and minimal vibration. Other miscellaneous equipment shall be started and operated as described above as applicable. Manufacturer's representative shall submit a preliminary written copy of equipment startup check sheet prior to leaving job site.
- c. After initial startup and operation of systems, the Contractor shall submit a report, showing proper operation before commencement of the final "Operation Test".
- d. During initial operation of the system and until substantial completion, qualified personnel shall be provided and designated for maintaining the equipment and systems in good running order. Items such as strainers, cleanouts, packing replacement, and other consumables shall be provided without cost to the Owner. Failure of equipment during this period due to lack of proper supervision is the responsibility of the Contractor and continued failures shall be grounds for the Owner to provide such services with back charges to the Contractor. Submit written schedule of completed maintenance to the Engineer.

G. System Acceptance:

1. General: The system installation shall be complete and tested for proper operation prior to acceptance testing "Operation Test" for the Owners authorized representative. A letter shall be submitted to the Engineer requesting system acceptance. This letter shall certify that all controls are installed and the software programs have been completely exercised for proper equipment operation. Acceptance testing shall commence at a mutually agreeable time within ten (10) calendar days of request. When the field test procedures have been demonstrated to the Owner's representative and pass, the system will be accepted. The warranty period may begin at this time.

H. Operation Test:

1. Provide all labor, equipment, and materials required to perform test.
2. The test shall occur after all major equipment startup and balance services have been performed as specified. The purpose is to demonstrate that individual pieces of equipment and all related elements operate as one complete system and not to identify incomplete or defective work.

3. All equipment is to be run in an automatic operating position and exercised for 72 hours to verify that they perform in accordance with the specified sequence of operation and designed operation logic.
4. The Engineer's representative shall be notified and may be present for the initiation of the test.
5. A log shall be prepared by the Contractor, to be submitted to the Engineer, of all tests including, but not limited to: time, temperatures, pressures, and other readings to prove all equipment is operating as specified.
6. All temperatures, pressures, status indication, etc., shall be verified by at least one other means of measurement or visual verification of condition.
7. Change set points and simulate conditions as directed to demonstrate:
  - a. Ability to control to new set point.
  - b. Interface between systems, fire alarm/fire sprinkler systems.
  - c. Proper sequence and operation.
  - d. Equipment safety systems and all automatic changeover/backup systems and alarms are functioning or will function.
8. If unsatisfactory performance or a system failure is experienced for any reason, the test shall be repeated until 72 hour consecutive hours are achieved. The Engineer's representative shall make all final decisions of a satisfactory test.

**END OF SECTION**

**SECTION 22 05 16**  
**EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Flexible pipe connectors.
- B. Expansion/seismic loops and compensators.

**1.2 RELATED REQUIREMENTS**

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 22.

**1.3 REFERENCE STANDARDS**

- A. EJMA (STDS) - EJMA Standards; Tenth Edition.

**1.4 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. Product Data:
  - 1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
  - 2. Expansion Loops/Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
- C. Maintenance Data: Include adjustment instructions.
- D. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

**1.5 REGULATORY REQUIREMENTS**

- A. Conform to UL and FM requirements.

**PART 2 PRODUCTS**

**2.1 FLEXIBLE PIPE CONNECTORS - STEEL PIPING**

- A. Manufacturers:
  - 1. Mercer Rubber Company: [www.mercer-rubber.com/#sle](http://www.mercer-rubber.com/#sle).
  - 2. The Metraflex Company: [www.metraflex.com/#sle](http://www.metraflex.com/#sle).
- B. Inner Hose: Stainless steel.
- C. Exterior Sleeve: Single braided, stainless steel.

Expansion Fittings and Loops for Plumbing  
Piping

- D. Pressure Rating: 125 psi up to 12 inch.
- E. Maximum Service Temperature: 450 degrees F.
- F. Joint: Flanged or threaded with union.
- G. Size: Use pipe sized units.
- H. Maximum offset: 3/4 inch on each side of installed center line.

## **2.2 FLEXIBLE PIPE CONNECTORS - COPPER PIPING**

- A. Manufacturers:
  - 1. Mercer Rubber Company: [www.mercer-rubber.com/#sle](http://www.mercer-rubber.com/#sle).
  - 2. The Metraflex Company: [www.metraflex.com/#sle](http://www.metraflex.com/#sle).
- B. Inner Hose: Bronze.
- C. Exterior Sleeve: Braided bronze.
- D. Pressure Rating: 125 psi up to 2 inch.
- E. Maximum Service Temperature: 450 degrees F.
- F. Joint: Flanged or threaded with union.
- G. Size: Use pipe sized units.
- H. Maximum offset: 3/4 inch on each side of installed center line.
- I. Application: Copper piping.

## **2.3 EXPANSION LOOPS**

- A. Manufacturers:
  - 1. Metraflex Metraloop.
  - 2. Twin Cities Hose Seismic 'V' Connector.
- B. Provide flexible expansion loops of size to match piping in which installed as shown on the Drawings.
- C. Flexible loops shall be designed to impart no thrust loads on the pipe anchors.
- D. The loop shall consist of two flexible sections of hose and braid, two 90 degree elbows and a 180 degree return. Hose and braid shall be T304 stainless steel. Fittings shall be carbon steel. Provide connection ends to match piping fitting requirements.
- E. Expansion loops shall be designed for 4 inches of movement in all directions and 4" axial movement. Maximum working pressure 150 PSI at 70 degrees.
- F. Install at all locations where piping crosses building seismic expansion joints.
- G. Expansion loops shall be certified for fluid/gas being transported for use in seismic applications.

## **2.4 EXPANSION LOOPS - HOSE AND BRAID**

- A. Manufacturers:
  - 1. The Metraflex Company; Metraloop: [www.metraflex.com/#sle](http://www.metraflex.com/#sle).

2. Unisource Manufacturing, Inc; V-Loop: [www.unisource-mfg.com/#sle](http://www.unisource-mfg.com/#sle).
- B. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support brackets and plugged drain port for steam service.
- C. Maximum Allowable Motion: 2 inch in the x, y, and z planes with no thrust loads to the building structure.
- D. Maximum Working Pressure: 150 psi at 800 degrees F.
- E. Construction: Class 150, schedule 40, stainless steel hose and braid assembly with carbon steel fittings, including elbows and flanged end connections sized to match pipe segment.
  1. Selected Product to Accommodate:
    - a. Angular Rotation: 15 degrees.
    - b. Force developed by 1.5 times specified maximum allowable operating pressure.
  2. Provide necessary accessories including, but not limited to, swivel joints.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.
- C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.
- D. Anchor pipe to building structure where indicated or required. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.
- E. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.
- F. Install seismic expansion loops at all points where piping crosses building expansion joints.

#### **END OF SECTION**

**SECTION 22 05 23**  
**GENERAL-DUTY VALVES FOR PLUMBING PIPING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Applications.
- B. Angle valves.
- C. Ball valves.
- D. Check valves.
- E. Gate valves.

**1.2 RELATED REQUIREMENTS**

- A. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
- B. Section 22 10 05 - Plumbing Piping.

**1.3 ABBREVIATIONS AND ACRONYMS**

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Non-rising stem.
- E. OS&Y: Outside screw and yoke.
- F. PTFE: Polytetrafluoroethylene.
- G. RS: Rising stem.
- H. SWP: Steam working pressure.
- I. TFE: Tetrafluoroethylene.
- J. WOG: Water, oil, and gas.

**1.4 REFERENCE STANDARDS**

- A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
- C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard; 2025.
- D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2022, with Errata (2023).
- E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
- F. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2020.
- G. ASME B31.9 - Building Services Piping; 2020.



- H. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023, with Errata (2024).
- I. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings; 2015 (Reapproved 2021).
- J. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.
- K. AWWA C606 - Grooved and Shouldered Joints; 2022.
- L. MSS SP-45 - Drain and Bypass Connections; 2020.
- M. MSS SP-67 - Butterfly Valves; 2022.
- N. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends; 2011.
- O. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.
- P. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.
- Q. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends; 2011.
- R. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.
- S. MSS SP-85 - Gray Iron Globe and Angle Valves, Flanged and Threaded Ends; 2011.
- T. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .
- U. MSS SP-125 - Check Valves: Gray Iron and Ductile Iron, In-Line, Spring-Loaded, Center-Guided; 2018.
- V. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.
- W. NSF 372 - Drinking Water System Components - Lead Content; 2022.

## **1.5 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.
- D. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.

## **1.6 QUALITY ASSURANCE**

- A. Manufacturer:

1. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

## **PART 2 PRODUCTS**

### **2.1 APPLICATIONS**

- A. Provide the following valves for the applications if not indicated on drawings:
  1. Shutoff: Ball, butterfly, gate.
  2. Throttling: Provide ball.
  3. Swing Check (Pump Outlet):
    - a. 2 inch and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
    - b. 2-1/2 inch and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves.
    - c. 2-1/2 inch and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.
- C. Required Valve End Connections for Non-Wafer Types:
  1. Steel Pipe:
    - a. 2 inch and Smaller: Threaded ends.
    - b. 2-1/2 inch to 4 inch: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
    - c. Grooved-End Steel Piping: Grooved.
  2. Copper Tube:
    - a. 2 inch and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
    - b. 2-1/2 inch to 4 inch: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
- D. Domestic, Hot and Cold Water Valves:
  1. All sizes:
    - a. Bronze and Brass: Provide with solder-joint or threaded ends.
    - b. Bronze Angle: Class 125, bronze disc.
    - c. Ball: Two piece, full port, brass with brass trim.
    - d. Bronze Swing Check: Class 125, bronze disc.
    - e. Bronze Gate: Class 125, NRS.

### **2.2 GENERAL REQUIREMENTS**

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types:

1. Gear Actuator: Quarter-turn valves 8 inch and larger.
  2. Handwheel: Valves other than quarter-turn types.
  3. Hand Lever: Quarter-turn valves 6 inch and smaller except plug valves.
  4. Wrench: Plug valves with square heads.
- D. Insulated Piping Valves: With 2 inch stem extensions and the following features:
1. Gate Valves: Rising stem.
  2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- E. Valve-End Connections:
1. Threaded End Valves: ASME B1.20.1.
  2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
  3. Pipe Flanges and Flanged Fittings 1/2 inch through 24 inch: ASME B16.5.
  4. Solder Joint Connections: ASME B16.18.
  5. Grooved End Connections: AWWA C606.
- F. General ASME Compliance:
1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
  2. Solder-joint Connections: ASME B16.18.
  3. Building Services Piping Valves: ASME B31.9.
- G. Potable Water Use:
1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
  2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.
- H. Valve Bypass and Drain Connections: MSS SP-45.

### **2.3 BRONZE, ANGLE VALVES**

- A. Class 125; CWP Rating: 200 psi:
1. Comply with MSS SP-80, Type 1.
  2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
  3. End Connections: Pipe thread.
  4. Stem: Bronze.
  5. Disc: Bronze.
  6. Packing: Asbestos free.
  7. Handwheel: Bronze or aluminum.

### **2.4 BRASS, BALL VALVES**

- A. Two Piece, Full Port with Brass Trim and Threaded or Soldered Connections:
1. Comply with MSS SP-110.
  2. Seats: PTFE.
  3. Ball: Chrome-plated brass.

## **2.5 BRONZE, BALL VALVES**

- A. General:
  - 1. Fabricate from dezincification resistant material.
  - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Two Piece, Full Port with Bronze Trim:
  - 1. Comply with MSS SP-110.
  - 2. WSP Rating: 150 psi.
  - 3. WOG Rating: 600 psi.
  - 4. Body: Forged bronze or dezincified-brass alloy.
  - 5. Ends Connections: Pipe thread or solder.
  - 6. Seats: PTFE.
  - 7. Stem: Bronze, blowout proof.
  - 8. Ball: Chrome plated brass.

## **2.6 BRONZE, LIFT CHECK VALVES**

- A. General:
  - 1. Fabricate from dezincification resistant material.
  - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Class 125:
  - 1. Comply with MSS SP-80, Type 1, Metal Disc to Metal Seat and Type 2, Nonmetallic Disc to Metal Seat.
  - 2. CWP Rating: 200 psi.
  - 3. Design: Vertical flow.
  - 4. Body: Comply with ASTM B61 or ASTM B62, bronze.
  - 5. End Connections: Threaded.

## **2.7 BRASS, INLINE CHECK VALVES**

- A. Class 150:
- B. Maximum Service Temperature: 250 degrees F.
- C. Body: Forged brass.
- D. Disc: Forged brass.
- E. Seal: PTFE, bubble-tight.
- F. End Connections: Press.

## **2.8 BRASS, HORIZONTAL SWING CHECK VALVES**

- A. Class 125, Threaded End Connections:
  - 1. WOG Rating: 200 psi.
  - 2. Body: Forged brass.
  - 3. Disc: Forged brass.
  - 4. Hinge-Pin, Screw, and Cap: Forged brass.

## **2.9 BRONZE, SWING CHECK VALVES**

- A. General:

1. Fabricate from dezincification resistant material.
  2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Class 125:
1. Pressure and Temperature Rating: MSS SP-80, Type 3.
  2. Design: Y-pattern, horizontal or vertical flow.
  3. WOG Rating: 200 psi.
  4. Body: Bronze, ASTM B62.
  5. End Connections: Threaded.
  6. Disc: Bronze.

## **2.10 BRONZE, GATE VALVES**

- A. General:
1. Fabricate from dezincification resistant material.
  2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. NRS (Non-rising Stem) or OS & Y (Rising Stem):
1. Comply with MSS SP-80, Type I.
  2. Class 125: CWP Rating 200 psig.
  3. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
  4. Ends: Threaded or solder joint joint.
  5. Stem: Bronze.
  6. Disc: Solid wedge; bronze.
  7. Packing: Asbestos free.
  8. Handwheel: Malleable iron, bronze, or aluminum.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.
- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
- D. Should valve is determined to be defective, replace with new valve.

### **3.2 INSTALLATION**

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
- C. Ball valves are not allowed to be installed underground.

- D. Underground service valves outside building to be installed in single piece concrete yard box with labeled cast iron cover.
- E. Provide minimum 12"x12" access doors for valves concealed behind rigid surfaces within building. Coordinate access door requirements with Div. 1.
- F. Install check valves where necessary to maintain direction of flow as follows:
  - 1. Lift Check: Install with stem plumb and vertical.
  - 2. Swing Check: Install horizontal maintaining hinge pin level.

**END OF SECTION**

**SECTION 22 05 29**  
**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Strut systems for pipe or equipment support.
- B. Beam clamps.
- C. Pipe hangers.
- D. Pipe rollers and roller supports.
- E. Pipe supports, guides, shields, and saddles.
- F. Seismic bracing hardware.
- G. Nonpenetrating rooftop supports for low-slope roofs.
- H. Anchors and fasteners.

**1.2 REFERENCE STANDARDS**

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).
- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
- J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
- K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

Hangers and Supports for Plumbing Piping  
and Equipment  
22 05 29 - 1

- L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
- M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).
- N. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

### **1.3 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
- C. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

## **PART 2 PRODUCTS**

### **2.1 GENERAL REQUIREMENTS**

- A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.
- B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.
- C. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
- D. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
- E. Fire Resistance: Provide hardware rated for 120 minutes resistance unless specifically indicated by the authority having jurisdiction.
- F. Materials for Metal Fabricated Supports: Comply with Section 05 50 00.
  - 1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
  - 2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.

Hangers and Supports for Plumbing Piping  
and Equipment



- G. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.

## **2.2 STRUT SYSTEMS FOR PIPE OR EQUIPMENT SUPPORT**

- A. Strut Channels:
  - 1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
  - 2. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.
- B. Hanger Rods:
  - 1. Threaded zinc-plated steel unless otherwise indicated.
  - 2. Minimum Size, Unless Otherwise Indicated or Required:
    - a. Equipment Supports: 3/8 inch diameter.
    - b. Piping up to 4 inch: 3/8 inch diameter.
    - c. Piping larger than 4 inch: 1/2 inch diameter.
    - d. Trapeze Support for Multiple Pipes: 3/8 inch in length.
- C. Channel Nuts:
  - 1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring as indicated on drawings.

## **2.3 BEAM CLAMPS**

- A. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
- B. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
- C. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

## **2.4 PIPE HANGERS**

- A. J-Hangers, Adjustable:
  - 1. MSS SP-58 type 5, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
  - 2. Felt-Lined: Provide for uninsulated pipe to reduce noise and prevent static issues.
- B. Swivel Ring Hangers, Adjustable:
  - 1. MSS SP-58 type 10, epoxy-painted, zinc-colored.
  - 2. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
  - 3. Felt-Lined: Provide for uninsulated pipe to reduce noise and prevent static issues.

Hangers and Supports for Plumbing Piping  
and Equipment

- C. Clevis Hangers, Adjustable:
  - 1. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.
  - 2. Felt-Lined: MSS SP-58 type 1, zinc-plated, silicone-free carbon steel.
  - 3. Light-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.
  - 4. Standard-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.

## **2.5 PIPE CLAMPS**

- A. Riser Clamps:
  - 1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
  - 2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
  - 3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
  - 4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.
- B. Extension Split Pipe Clamp:
  - 1. MSS SP-58 type 12, hinged split ring and yoke roller hanger with epoxy copper or plain finish.
  - 2. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
  - 3. Provide hanger rod and nuts of the same type and material for a given pipe run.
  - 4. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
- C. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.
- D. Strut Clamps:
  - 1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.
  - 2. Cushioned Pipe or Tubing Strut Clamp: Provide strut clamp with thermoplastic elastomer cushion having dielectric strength of 670 V/mil.
- E. Insulation Coupling:
  - 1. Two bolt-type clamps designed for installation under insulation.
  - 2. Material: Carbon steel with epoxy copper or zinc finish.

## **2.6 PIPE ROLLERS AND ROLLER SUPPORTS**

- A. MSS SP-58 type 43 based on required load, nonconductive and corrosion resistant.
- B. Material: Zinc plated ASTM A36/A36M carbon steel or ASTM A47/A47M malleable iron.

## **2.7 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES**

- A. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.
- B. Stanchions:
  - 1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
  - 2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.
  - 3. For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.
- C. U-Bolts:
  - 1. MSS SP-58 type 24, carbon steel u-bolt for pipe support or anchoring.
- D. Pipe Alignment Guides:
  - 1. Pipe Sizes 8 inch and Smaller: Spider or sleeve type.
  - 2. Pipe Sizes 10 inch and Larger: Roller type.
- E. Pipe Shields for Insulated Piping:
  - 1. MSS SP-58 type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
  - 2. General Construction and Requirements:
    - a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
    - b. Shields Material: UV-resistant polypropylene with glass fill.
    - c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
    - d. Service Temperature: Minus 40 to 178 degrees F.
    - e. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
- F. Pipe Supports:
  - 1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
  - 2. Liquid Temperatures Up to 122 degrees F:
    - a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.
    - b. Support From Below: MSS SP-58 types 35 through 38.
  - 3. Operating Temperatures from 122 to 446 degrees F:
    - a. Overhead Support: MSS SP-58 type 1 or 3 through 12 clamps with appropriate saddle of MSS SP-58 type 40 for insulated pipe.
    - b. Roller Chair: MSS SP-58 types 41 or 43 through 46 roller chair support with appropriate saddle of MSS SP-58 type 39 for insulated pipe.
    - c. Sliding Support: MSS SP-58 types 35 through 38.
- G. Pipe Supports, Thermal Insulated:

1. General Requirements:
  - a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
  - b. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.
  - c. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
  - d. Provide pipe supports for 1/2 to 30 inch iron pipes.
  - e. Insulation inserts to consist of rigid phenolic foam insulation surrounded by 360 degree, PVC jacketing.
2. PVC Jacket:
  - a. Pipe insulation protection shields to be provided with ball bearing hinge and locking seam.
  - b. Minimum Service Temperature: Minus 40 degrees F.
  - c. Maximum Service Temperature: 180 degrees F.
  - d. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
  - e. Minimum Thickness: 60 mil, 0.06 inch.

## **2.8 SEISMIC BRACING HARDWARE**

- A. Cable Sway Bracing Systems:
  1. Cable wire hanger with fix and release spring mechanism enclosed using zinc housing with 302 stainless steel components for pipe or equipment suspension to surface-mounted end-fixing fittings.
  2. Provide cable wire and end-fixing as required to hold minimum weight of 100 lb.

## **2.9 NONPENETRATING ROOFTOP SUPPORTS FOR LOW-SLOPE ROOFS**

- A. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
- B. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
- C. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
- D. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

## **2.10 ANCHORS AND FASTENERS**

- A. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

Hangers and Supports for Plumbing Piping  
and Equipment  
22 05 29 - 6

- B. Concrete: Use preset concrete inserts or expansion anchors.
- C. Solid or Grout-Filled Masonry: Use expansion anchors.
- D. Hollow Masonry: Use toggle bolts.
- E. Hollow Stud Walls: Use toggle bolts.
- F. Steel: Use beam clamps, machine bolts, or welded threaded studs.
- G. Sheet Metal: Use sheet metal screws.
- H. Wood: Use wood screws.
- I. Plastic and lead anchors are not permitted.
- J. Powder-actuated fasteners are not permitted.
- K. Hammer-driven anchors and fasteners are not permitted.
- L. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
- M. Preset Concrete Inserts: Continuous metal strut channel and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
  - 1. Channel Material: Use galvanized steel.
  - 2. Manufacturer: Same as manufacturer of metal strut channel framing system.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

#### **3.2 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- D. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

- G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
  - H. Equipment Support and Attachment:
    - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
    - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
    - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
    - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
  - I. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.
  - J. Secure fasteners according to manufacturer's recommended torque settings.
  - K. Remove temporary supports.
- 3.3 FIELD QUALITY CONTROL**
- A. Inspect support and attachment components for damage and defects.
  - B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
  - C. Correct deficiencies and replace damaged or defective support and attachment components.

**END OF SECTION**

**SECTION 22 05 53**  
**IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Underground warning tape.

**1.2 RELATED REQUIREMENTS**

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

**1.3 REFERENCE STANDARDS**

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

**1.4 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

**PART 2 PRODUCTS**

**2.1 IDENTIFICATION APPLICATIONS**

- A. Heat Transfer Equipment: Nameplates.
- B. Major Control Components: Nameplates.
- C. Piping: Pipe markers.
- D. Pumps: Nameplates.
- E. Small-sized Equipment: Tags.
- F. Tanks: Nameplates.
- G. Valves: Tags and ceiling tacks where located above lay-in ceiling.
- H. Water Treatment Devices: Nameplates.

**2.2 MANUFACTURERS**

- A. Brady Corp.

Identification for Plumbing Piping and  
Equipment  
22 05 53 - 1

- B. Seton Identification Products.

### **2.3 NAMEPLATES**

- A. Description: Laminated piece with up to three lines of text.
  - 1. Letter Color: White.
  - 2. Letter Height: 1/4 inch.
  - 3. Background Color: Black.
  - 4. Plastic: Comply with ASTM D709.

### **2.4 TAGS**

- A. Metal: Brass, 19 gauge 1-1/2 inch in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.

### **2.5 PIPE MARKERS**

- A. Comply with ASME A13.1.
- B. Flexible Marker: Factory fabricated, semi-rigid, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid conveyed.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Secure to pipe using two (2) bands of adhesive tape with flow arrows supplied by the manufacturer. Install securing bands completely around pipe and overlapped.
- D. Underground Flexible Marker: Bright-colored continuously printed ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

### **2.6 UNDERGROUND WARNING TAPE**

- A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil, 0.004 inch.
- C. Legend: Type of service, continuously repeated over full length of tape.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Degrease and clean surfaces to receive identification products.

### **3.2 INSTALLATION**

- A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags in clear view and align with axis of piping



- C. Install plastic tape pipe marker around pipe in accordance with manufacturer's instructions.
- D. Identify domestic hot water heating equipment, including pumps, etc. with plastic nameplates.
- E. Identify valves in main and branch piping with tags.
- F. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- G. Identify all medium pressure gas piping (over 11" W.C. to 5 PSI pressure) with pressure contained within piping system (for example: "MPG 5 PSI")

**END OF SECTION**

**SECTION 22 07 19**  
**PLUMBING PIPING INSULATION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Flexible elastomeric cellular insulation.
- B. Piping insulation.
- C. Glass fiber insulation.
- D. Jacketing and accessories.

**1.2 RELATED REQUIREMENTS**

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

**1.3 REFERENCE STANDARDS**

- A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).
- D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- E. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2017 (Reapproved 2023).
- F. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.
- G. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.
- H. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2022.
- I. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).
- J. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.
- K. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.
- L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

- M. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
- N. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
- O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

#### **1.4 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

#### **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

#### **1.7 FIELD CONDITIONS**

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

### **PART 2 PRODUCTS**

#### **2.1 REGULATORY REQUIREMENTS**

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

#### **2.2 GLASS FIBER INSULATION**

- A. Manufacturers:
  - 1. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).
  - 2. Johns Manville Corporation: [www.jm.com/#sle](http://www.jm.com/#sle).
  - 3. Knauf Insulation: [www.knaufusa.com](http://www.knaufusa.com).
  - 4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.

1. 'K' value: ASTM C 177, 0.22 to 0.28 at 100 degrees F.
  2. Maximum Service Temperature: 850 degrees F.
  3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm.
- D. Vapor Barrier Lap Adhesive: Compatible with insulation.

## **2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION**

- A. Manufacturers:
1. Armacell LLC; AP Armaflex: [www.armacell.us/#sle](http://www.armacell.us/#sle).
  2. K-Flex USA LLC; Insul-Tube: [www.kflexusa.com/#sle](http://www.kflexusa.com/#sle).
  3. Owens Corning Flex Tubing
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 3; use molded tubular material wherever possible and sheet for equipment and other surfaces.
1. 'K' value: ASTM C 177; 0.27 at 75 degrees F.
  2. Minimum Service Temperature: Minus 40 degrees F.
  3. Maximum Service Temperature: 220 degrees F.
  4. Maximum Moisture Absorption - Pipe Insulation: 3.5 percent, by weight, when tested in accordance with ASTM D 1056.
  5. Water Vapor Permeability: 0.20 perm-inches, when tested in accordance with ASTM E 96.
  6. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive:
- D. Insulation Exposed to the Weather: Finish with two coats Armstrong white Armaflex finish. Provide aluminum jacketing.

## **2.4 JACKETING AND ACCESSORIES**

- A. PVC Plastic Jacket:
1. Manufacturers:
    - a. Proto Corporation, Proto-Wrap 30 LoSmoke.
    - b. Johns Manville Corporation: [www.jm.com](http://www.jm.com).
  2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
    - a. Minimum Service Temperature: 0 degrees F.
    - b. Maximum Service Temperature: 150 degrees F.
    - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
    - d. Thickness: 10 mil, 0.010 inch.
    - e. Connections: Brush on welding adhesive.
  3. Covering Adhesive Mastic: Compatible with insulation.
- B. Aluminum Jacket:

1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
2. Thickness: 0.016 inch sheet.
3. Finish: Embossed.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

#### **3.2 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Glass fiber insulated pipes conveying fluids below ambient temperature:
  1. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with molded PVC fitting covers.
- D. Glass fiber insulated pipes conveying fluids above ambient temperature:
  1. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with molded PVC fitting covers.
- E. Inserts and Shields:
  1. Application: Piping 1-1/2 inches diameter or larger.
  2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
  3. Insert Location: Between support shield and piping and under the finish jacket.
  4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
  5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- F. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, use a UL rated fire penetration assembly, 3M or equal.
- G. Pipe in Supply Air Plenum or Finished Spaces: Finish with PVC jacket and fitting covers.
- H. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces: Finish with PVC jacket and fitting covers.

- I. Exterior Applications (exposed to the weather): Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

### **3.3 SCHEDULES**

- A. Plumbing Systems:
  1. Domestic Hot and Tempered Water Supply:
    - a. Glass Fiber Insulation:
      - 1) Pipe Size Range: 1-1/2 inch and larger.
        - (a) Thickness: 2 inch.
      - 2) Pipe Size Range: 1 inch and smaller.
        - (a) Thickness: 1-1/2 inch.
  2. Domestic Cold Water Located in Unheated Areas:
    - a. Glass Fiber Insulation:
      - 1) Pipe Size Range: 1-1/2 inch and larger.
        - (a) Thickness: 1 inch.
      - 2) Pipe Size Range: 1 inch and smaller.
        - (a) Thickness: 3/4 inch.

**END OF SECTION**

**SECTION 22 08 00  
PLUMBING COMMISSIONING REQUIREMENTS**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to the Work of this Section.
- B. Specific commissioning requirements are given in the following sections of these specifications. It is the contractor's responsibility to coordinate all HVAC systems testing with the GC and all other trades performing related testing services. The division 22 contractor shall provide all T24 required testing by what T24 calls "Certified Acceptance Test Technician". All such tests shall be provided to the districts CxA for inclusion into the CxA reports and submitted according to T24 requirements.
  - 1. 01 91 00 - General Commissioning Requirements
  - 2. 26 08 00 - Electrical Commissioning Requirements
  - 3. 23 08 00 - Mechanical Commissioning Requirements
  - 4. ASHRAE Guideline 0-2019 or superseding ASHRAE guideline
  - 5. SUBMITALS
    - a. General:
      - 1) Comply with Section –Submittal Procedures.
      - 2) See submittal requirements in Section 01 91 00–General Commissioning Requirements
      - 3) Prior to pre-functional testing:
        - (a) Provide a TAB plan for approval by the CxA
        - (b) Provide all Pre-Functional Tests for approval to the CxA
    - 6. COORDINATION
      - a. The Contractor shall coordinate all testing and balancing and major equipment startup and installation with the Commissioning Provider (CxA) and the CM.
      - b. For the Plumbing domestic water equipment, the Contractor shall provide a short discussion of the control of the plumbing equipment during the mechanical or electrical training conducted by others.

**PART 2 PRODUCTS**

**2.1 TEST EQUIPMENT**

- A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Trade Contractor for the equipment being tested.
- B. Datalogging equipment or software required to test equipment will be provided by the contractor, if required, but shall not become the property of the Owner.

- C. All testing equipment shall be of sufficient quality and accuracy to test or measure system performance required by the Contract Documents.

## **PART 3 EXECUTION**

### **3.1 TESTING PREPARATION**

- A. General Procedures are described in Section 01 91 00 – General Commissioning Requirements.
- B. Contractor shall perform all pre-functional performance tests with the tests approved by the CxA. The CxA and the owner shall be advised of all tests as required in this section and by the general commissioning requirements in 01 91 00.
- C. Pre-functional Checklists shall be completed and provided to the CxA for the following Plumbing systems:
  - 1. Contractor to develop, fill out and sign approved pre-functional checklists according to 01 91 00 for the following equipment and systems .These tests shall be provided even if the CxA does not provide related Functional performance tests for these systems:
    - a. Domestic Hot Water System
    - b. Potable water system and booster pumps, as applicable
      - 1) Contractor shall certify that Plumbing systems, subsystems, and equipment are completed, calibrated, and started based on the tests verified and approved by the CxA.
- D. **FUNCTIONAL PERFORMANCE TESTING**
  - 1. General procedures are described in the Division 01 Section "General Commissioning Requirements." 01 91 00
  - 2. Contractor shall execute all functional performance tests provided by the Commissioning Provider. No functional tests shall be performed without the CxA present.
  - 3. The details of the functional performance tests shall be reviewed and refined during the construction phase by the CxA. The final test will be provided to the contractor at least 5 business days before the test is conducted.
- E. **ELECTRONIC DOCUMENT REQUIREMENTS**
  - 1. All working documents shall be provided in electronic format whenever feasible. Hard copies are only permissible if soft copies of the documents are not available.
  - 2. In addition to the hard copy requirements required in this section, at least all final documents shall be provided un pdf format, organized and tabulated identical to any hard copies provided. Coordinate media requirements with the owner at the time of submission

### **END OF SECTION**



## **SECTION 22 10 05 PLUMBING PIPING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Sanitary waste piping, buried within 5 feet of building.
- B. Sanitary waste piping, above grade.
- C. Drains.
- D. Domestic water piping, buried within 5 feet of building.
- E. Domestic water piping, above grade.
- F. Storm drainage piping, buried within 5 feet of building.
- G. Storm drainage piping, above grade.
- H. Pipe flanges, unions, and couplings.
- I. Pipe hangers and supports.

#### **1.2 RELATED REQUIREMENTS**

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.
- C. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
- D. Section 22 07 19 - Plumbing Piping Insulation.

#### **1.3 REFERENCE STANDARDS**

- A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems; 2015 (Reaffirmed 2020).
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
- C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
- E. ASME B31.9 - Building Services Piping; 2020.
- F. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2023.
- G. ASSE 1003 - Water Pressure Reducing Valves for Potable Water Distribution Systems; 2023.
- H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
- I. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2021.
- J. ASTM B32 - Standard Specification for Solder Metal; 2020.

- K. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2020.
- L. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
- M. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.
- N. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2024.
- O. AWWA C651 - Disinfecting Water Mains; 2023.
- P. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.
- Q. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2020.
- R. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).
- S. MSS SP-67 - Butterfly Valves; 2022.
- T. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
- U. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
- V. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.
- W. NSF 372 - Drinking Water System Components - Lead Content; 2022.

#### **1.4 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Project Record Documents: Record actual locations of valves.

#### **1.5 QUALITY ASSURANCE**

- A. Perform Work in accordance with State of California, standards.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

#### **1.6 REGULATORY REQUIREMENTS**

- A. Perform Work in accordance with State of California plumbing code.

- B. Domestic water piping and components shall be provided and installed in accordance with California AB 1953 Legislation (effective January 1, 2010), which limits the allowable lead content in certain domestic water system components.
- C. Conform to applicable code for installation of backflow prevention devices.
- D. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

## **PART 2 PRODUCTS**

### **2.1 GENERAL REQUIREMENTS**

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

### **2.2 SANITARY SEWER PIPING, BURIED**

- A. Cast Iron Pipe: CISPI 301, hubless.
  - 1. Fittings: Cast iron.
  - 2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies. Heavy duty, Husky SD4000, .015 inch thick 304 stainless steel shield, 4-band coupling.
- B. PVC Pipe: Schedule 40 Solid Core. ASTM D1785, ASTM D2665.
  - 1. Fittings: PVC.
  - 2. Joints: Solvent welded, with ASTM D2564 solvent cement and ASTM F656 primer.

### **2.3 DRAIN PIPING, ABOVE GRADE**

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
  - 1. Fittings: Cast iron.
  - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.
- B. PVC Pipe: Schedule 40 Solid Core. ASTM D1785, ASTM D2665.
  - 1. Application: sanitary waste and vent, and condensate drains inside building.
  - 2. Fittings: PVC.

3. Joints: Solvent welded, with ASTM D2564 solvent cement and ASTM F656 primer.
- C. Steel Pipe: ASTM A53/A53M, Grade B, Type F, Schedule 40, galvanized.
  1. Application: Condensate drains outside building (non-acidic).
  2. Threaded Joints: ASME B16.3 malleable iron fittings.
- 2.4 WATER PIPING, BURIED**
  - A. Copper Pipe: ASTM B 42, hard drawn, Type K.
    1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
    2. Joints: AWS A5.8M/A5.8, BCuP copper and silver braze.
- 2.5 DOMESTIC WATER PIPING, ABOVE GRADE**
  - A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
    1. Fittings: ASME B16.18, cast copper alloy.
    2. Joints: For sizes 1-1/2" and smaller, ASTM B 32, alloy Sn95 solder.
    3. Joints: For sizes 2" and larger, AWS A5.8, BCuP5 silver braze.
  - B. Provide full solder cup for all fittings.
  - C. Schedule 40 Screwed Brass: Capped or plugged outlets.
- 2.6 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING**
  - A. Storm drainage piping below grade to match sanitary drain piping below grade.
- 2.7 STORM DRAINAGE PIPING, ABOVE GRADE**
  - A. Storm drainage piping above grade to match sanitary drain piping above grade.
- 2.8 PIPE FLANGES, UNIONS, AND COUPLINGS**
  - A. Unions for Pipe Sizes 2 Inches and Under:
    1. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.
  - B. Flanges for Pipe Sizes Over 2 inch:
    1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
    2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
  - C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
- 2.9 PIPE HANGERS AND SUPPORTS**
  - A. See Section 22 05 29 for additional requirements.
- 2.10 GAS PRESSURE REGULATING VALVES**
  - A. Provide single stage, steel jacketed, corrosion resistant gas pressure regulating valves with atmospheric vent and elevation compensator sized for inlet and outlet pressures , specific gravity and volume indicated on the drawings.
  - B. Compliance requirements:

1. Appliance Regulator: ANSI Z21.18/CSA 6.3.
  2. Line Pressure Regulator: ANSI Z21.80/CSA 6.22.
- C. For sizes 2" and smaller: threaded ends.
  - D. For sizes 2-1/2" and larger: flanged ends.
  - E. Provide high and low pressure cutout and internal relief for each regulator.

## **2.11 SEISMIC GAS SHUTOFF VALVES**

- A. Manufacturers: Safetquake, Quakemaster or equal.
- B. Valve is fabricated of aluminum, incorporates a stainless steel ball and bubble level, is vertically mounted, has a single step manual reset lever, operates at ambient temperature range of -40 deg F to +150 Deg F, minimum pressure .5 psi and maximum allowable pressure of 60 psi.
- C. Valves actuates within 5 seconds when subjected to a horizontal sinusoidal oscillation having a peak acceleration of anyone of the following: (1) 0.70g and period of 0.13 second, (2) 0.40g and period of 0.20 second, (3) 0.30g and period of 0.40 second, (4) 0.25g and period of 1.00 second.
- D. Meets or exceeds California standard, ANSI (Z21 1995), California Office of State Architect (Label Numbers CA-OSA 19.49 and CA-OSA 27.02, IAPMO, UPC (file 3D94), AGA P-70-2A, U.L. Building and Safety RR 4996.

## **2.12 WATER PRESSURE REDUCING VALVES**

- A. 2 inch and Smaller:
  1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.
  2. Pressure Reducing Pilot-Operator:
    - a. Operating Range: 5 to 50 psi.
    - b. Connected into brass or bronze pilot piping and fittings.
    - c. Fixed flow restrictor, pressure gauges, and isolation valves.
- B. 2 inch and Larger:
  1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.
  2. Pressure Reducing Pilot-Operator:
    - a. Operating Range: 5 to 50 psi.
    - b. Connected into brass or bronze pilot piping and fittings.
    - c. Fixed flow restrictor, strainer, pressure gauges, and isolation valves.

## **2.13 PRESSURE RELIEF VALVES**

- A. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.
- B. Temperature and Pressure:

1. ANSI Z21.22, AGA certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME BPVC-IV certified and labelled.

## **2.14 STRAINERS**

- A. Size 2 inch and Smaller:
  1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
  2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that excavations are to required grade, dry, and not over-excavated.

### **3.2 PREPARATION**

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

### **3.3 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed.
- I. Provide anodeless transition riser at gas piping transition from below grade to above grade.
- J. All natural gas piping exposed to outdoors shall be primed and painted, color by architect.
- K. All ABS and PVC pipe material exposed to outdoors shall be primed and painted, color by architect.
- L. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.

- M. Install valves with stems upright or horizontal, not inverted. See Section 22 05 23.
- N. Install water piping to ASME B31.9.
- O. Sleeve pipes passing through partitions, walls, and floors.
- P. Pipe Hangers and Supports:
  - 1. Install in accordance with ASME B31.9.
  - 2. Support horizontal piping as indicated.
  - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 4. Place hangers within 12 inches of each horizontal elbow.
  - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 6. Provide copper plated hangers and supports for copper piping.
  - 7. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
  - 8. Support cast iron drainage piping at every joint.

### **3.4 APPLICATION**

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

### **3.5 TOLERANCES**

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.
- B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

### **3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM**

- A. Prior to starting work, verify system is complete, flushed, and clean.
- B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

### **3.7 SCHEDULES**

- A. Pipe Hanger Spacing:
  - 1. Metal Piping:
    - a. Pipe Size: 1/2 inch to 1-1/4 inch:
      - 1) Maximum Hanger Spacing: 6.5 ft.
      - 2) Hanger Rod Diameter: 3/8 inches.
    - b. Pipe Size: 1-1/2 inch to 2 inch:
      - 1) Maximum Hanger Spacing: 10 ft.
      - 2) Hanger Rod Diameter: 3/8 inch.
    - c. Pipe Size: 2-1/2 inch to 3 inch:
      - 1) Maximum Hanger Spacing: 10 ft.
      - 2) Hanger Rod Diameter: 1/2 inch.
    - d. Pipe Size: 4 inch to 6 inch:
      - 1) Maximum Hanger Spacing: 10 ft.
      - 2) Hanger Rod Diameter: 5/8 inch.

**END OF SECTION**



**SECTION 22 10 06  
PLUMBING PIPING SPECIALTIES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Floor drains.
- B. Cleanouts.
- C. Hose bibbs.
- D. Double check valve assemblies.
- E. Water hammer arrestors.
- F. Trap primers.

**1.2 RELATED REQUIREMENTS**

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 22 10 05 - Plumbing Piping.

**1.3 REFERENCE STANDARDS**

- A. ASME A112.6.3 - Floor Drains; 2022.
- B. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent; 2021.
- C. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2023.
- D. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.
- E. NSF 372 - Drinking Water System Components - Lead Content; 2022.
- F. PDI-WH 201 - Water Hammer Arresters; 2017.

**1.4 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- D. Project Record Documents: Record actual locations of equipment, cleanouts, water hammer arrestors.
- E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

**1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

## **1.6 REGULATORY REQUIREMENTS**

- A. Perform Work in accordance with State of California plumbing code.
- B. Domestic water piping and components shall be provided and installed in accordance with California AB 1953 Legislation (effective January 1, 2010), which limits the allowable lead content in certain domestic water system components.
- C. Conform to applicable code for installation of backflow prevention devices.
- D. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Accept specialties on site in original factory packaging. Inspect for damage.

## **PART 2 PRODUCTS**

### **2.1 GENERAL REQUIREMENTS**

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

### **2.2 REFER TO PLUMBING SCHEDULE FOR PLUMBING PIPING SPECIALTIES NOT LISTED HEREIN.**

### **2.3 DRAINS**

- A. Manufacturers:
  - 1. Jay R. Smith Manufacturing Company.
  - 2. Zurn Industries, LLC: [www.zurn.com/#sle](http://www.zurn.com/#sle).
- B. Downspout Nozzles:
  - 1. Bronze round with straight bottom section. Zurn Z-199.
- C. Floor Drain (FD):
  - 1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.
  - 2. Provide accessories suitable for wood raised floor installation.
- D. Floor Sink (FS):
  - 1. Lacquered cast iron body with white acid resisting porcelain interior and top complete with aluminum anti-splash bottom dome strainer, square slotted medium duty half grate, anchor and seepage flange.

### **2.4 CLEANOUTS**

- A. Manufacturers:
  - 1. Jay R. Smith Manufacturing Company: [www.jayrsmith.com/#sle](http://www.jayrsmith.com/#sle).
  - 2. Josam Company: [www.josam.com/#sle](http://www.josam.com/#sle).

- 3. Zurn Industries, LLC: [www.zurn.com/#sle](http://www.zurn.com/#sle).
- B. Cleanouts at Exterior Surfaced Areas:
  - 1. Round cast nickel bronze access frame and non-skid cover.
- C. Cleanouts at Exterior Unsurfaced Areas:
  - 1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.
- D. Cleanouts at Interior Finished Floor Areas :
  - 1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and nickel bronze round gasketed scored cover in service areas and round or square nickel bronze gasketed depressed cover to accept floor finish in finished floor areas. Zurn ZN-1400.
- E. Cleanouts at Interior Finished Wall Areas:
  - 1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw. Zurn Z-1441 or Z-1443.
- F. Cleanouts in concealed aboveground cast iron soil or waste lines: Zurn Z-1440A with raised head ABS plastic plug.

## **2.5 VENT CAPS**

- A. All sanitary plumbing vents terminating above roof to be provided with vandal proof hooded type vent cap: JR Smith 1748, or equal.

## **2.6 HOSE BIBBS**

- A. Manufacturers:
  - 1. Arrowhead Brass.
  - 2. Zurn Industries, Inc.
  - 3. Chicago Faucets.

## **2.7 DOUBLE CHECK-VALVE ASSEMBLIES**

- A. Manufacturers:
  - 1. Watts Regulator Company.
  - 2. Febco.
- B. Double Check Valve Assembly:
  - 1. ASSE 1012; cast bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.
  - 2. Size: 3/4 to 2 inch, NPS assembly with threaded full port ball valves.

## **2.8 TRAP PRIMERS**

- A. Provide trap primers, 1/2 inch size, where indicated on drawings. Provide with built-in air gap and install 1/2" shutoff valve. PVC housings are not acceptable. Install trap primer line with 1/4" per foot slope to insure full drainage to floor drain or floor sink. Install tap primer behind wall with access door.

- B. Provide a distribution unit with feeder piping for a maximum of four (4) traps where multiple traps are serviced by a single trap primer.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface as indicated on plans. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install cleanouts in all horizontal soil and waste piping at 100 feet maximum spacing inside building, 100 feet maximum spacing outside building, at every 135 degree change of direction and where shown on Drawings.
- E. Install two way cleanout in building drain (waste line leaving the building) just outside of the building.
- F. Install cleanouts in waste drops from each urinal and sink.
- G. Install cleanouts in rain water (storm drain) drops 18 inches above finished floor. For concealed rainwater drops extend cleanout to building exterior for access.
- H. Install floor cleanouts at elevation to accommodate finished floor.
- I. Pipe relief from backflow preventer to nearest drain.
- J. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to and water closets and as shown on plans.

#### **END OF SECTION**

**SECTION 22 30 00  
PLUMBING EQUIPMENT**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Tankless electric water heaters.
- B. Commercial electric water heaters.
- C. In-line circulator pumps.
- D. Condensate removal pumps.
- E. Expansion Tanks.

**1.2 RELATED REQUIREMENTS**

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

**1.3 REFERENCE STANDARDS**

- A. ANSI Z21.10.1 - Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less; 2019, with Errata (2020).
- B. ANSI Z21.10.3 - Gas-Fired Water Heaters, Volume III, Storage Water Heaters with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous; 2019.
- C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.
- E. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Current Edition, Including All Revisions.

**1.4 REFERENCE STANDARDS**

- A. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 1996.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association; 1999.

**1.5 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. Product Data:
  - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
  - 2. Provide electrical characteristics and connection requirements.
- C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

## **1.6 QUALITY ASSURANCE**

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

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

## **1.8 WARRANTY**

- A. See Division 1 for additional warranty requirements.
- B. Manufacturer Warranty: Provide 5-year manufacturer warranty for domestic water heaters. Complete forms in Owner's name and register with manufacturer.

# **PART 2 PRODUCTS**

## **2.1 WATER HEATERS**

- A. Tankless Electric Water Heater:
  - 1. Manufacturers:
    - a. Chronomite, Inc: [www.chronomite.com/#sle](http://www.chronomite.com/#sle).
    - b. Eemax: [www.eemax.com](http://www.eemax.com).
  - 2. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
  - 3. Water Inlet Pressure: From 30 psi to 150 psi.
  - 4. Heater Type: Self-contained, wall-mounted unit capable of handling listed capacity, water-inlet strainer, removable thermally-insulated front panel, and threaded water pipe-end connections.
  - 5. Heater-Heat Exchanger: Stainless steel, thermally insulated and encased assembly in corrosion-resistant steel jacket; baked-on enamel finish.
  - 6. Safeties: Provide internal safeties for water flow, electrical load, and thermal load.
  - 7. Controls: Setpoint dial interface for internal controls; temperature range adjustable from 120 to 170 degrees F using flanged or screw-in nichrome elements. Wire double-element units so elements do not operate simultaneously.
- B. Commercial Electric Water Heaters:
  - 1. Manufacturers:
    - a. A.O. Smith Water Products Co<>: [www.hotwater.com/#sle..](http://www.hotwater.com/#sle..)
    - b. More-Flo
    - c. American Water Heaters
  - 2. Type: Factory-assembled and wired, electric, vertical storage.
  - 3. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.

4. Tank: Glass lined welded steel; 4 inch diameter inspection port, thermally insulated with minimum 2 inches foam plastic encased in corrosion-resistant steel jacket; baked-on enamel finish.
5. Accessories:
  - a. Water Connections: Brass.
  - b. Dip Tube: Brass.
  - c. Drain valve.
  - d. Anode: Magnesium.
  - e. Temperature and Pressure Relief Valve: ASME labeled.
6. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 W/sq in.

## **2.2 IN-LINE CIRCULATOR PUMPS**

- A. Manufacturers:
  1. Bell & Gossett, a xylem brand: [www.bellgossett.com/#sle](http://www.bellgossett.com/#sle).
  2. Grundfos.
- B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.
- C. Impeller: Bronze.
- D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
- E. Seal: Carbon rotating against a stationary ceramic seat.
- F. Drive: Flexible coupling.

## **2.3 CONDENSATE REMOVAL PUMPS**

- A. Manufacturers:
  1. Liberty Pumps Inc: [www.libertypumps.com/#sle](http://www.libertypumps.com/#sle).
  2. Little Giant Pumps: [www.littlegiant.com](http://www.littlegiant.com)
  3. Blue Diamond Pumps Inc: [www.bluediamondpumps.com](http://www.bluediamondpumps.com)
- B. Construction: Commercial grade, nonferrous pump with stainless steel shaft, integral discharge check valve, integral float switch, safety switch, thermoplastic reservoir, motor assembly, and power cord with ground.
- C. Safety: UL 778.

## **2.4 EXPANSION TANK**

- A. Manufacturers:
  1. Amtrol Inc: [www.amtrol.com/#sle](http://www.amtrol.com/#sle).
  2. Bell & Gossett, a xylem brand: [www.bellgossett.com/#sle](http://www.bellgossett.com/#sle).
  3. Taco, Inc: [www.tacomfort.com/#sle](http://www.tacomfort.com/#sle).
- B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working

pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

- C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 38 psig.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions required for applicable certifications.
- B. Coordinate with plumbing piping and related fuel piping, gas venting, and electrical work to achieve operating system.
- C. Provide and install CPVC piping for combustion air intake and flue for gas fired water heaters where scheduled and as shown on the drawings. Install in accordance with manufacturer's installation instructions.
- D. Pumps:
  - 1. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
  - 2. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.
  - 3. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

**END OF SECTION**



**SECTION 22 40 00  
PLUMBING FIXTURES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Flush valve water closets.
- B. Wall hung urinals.
- C. Lavatories.
- D. Sinks.
- E. Indoor drinking fountains.
- F. Service sinks.

**1.2 RELATED REQUIREMENTS**

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 22 10 05 - Plumbing Piping.
- C. Section 22 10 06 - Plumbing Piping Specialties.

**1.3 REFERENCE STANDARDS**

- A. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008 (Reaffirmed 2013).
- B. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).
- C. ASME A112.18.1 - Plumbing Supply Fittings; 2024.
- D. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2022).
- E. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2024.
- F. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2022.
- G. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2022.
- H. ASSE 1014 - Performance Requirements for Backflow Prevention Devices for Hand-Held Showers; 2020.
- I. ASSE 1016 - Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations; 2017 (Reaffirmed 2021).
- J. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2020.
- K. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2021.
- L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

- M. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.
- N. NSF 372 - Drinking Water System Components - Lead Content; 2022.

#### **1.4 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

#### **1.5 QUALITY ASSURANCE**

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

#### **1.6 REGULATORY REQUIREMENTS**

- A. Perform Work in accordance with State of California plumbing code.
- B. Domestic water piping and components shall be provided and installed in accordance with California AB 1953 Legislation (effective January 1, 2010), which limits the allowable lead content in certain domestic water system components.
- C. Conform to applicable code for installation of backflow prevention devices.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Accept fixtures on-site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

#### **1.8 WARRANTY**

- A. See Division 1 for additional warranty requirements.

### **PART 2 PRODUCTS**

#### **2.1 GENERAL REQUIREMENTS**

- A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

#### **2.2 GENERAL REQUIREMENTS:**

- A. Refer to Architectural drawings for exact locations, fixture mounting heights and ADA accessibility requirements.
- B. Fixture supplies to be no-burst stainless steel braided. Brasscraft model B1F16 for lavatories and Brasscraft model 1T16 for water closets. All supplies to have threaded connections.

- C. Insulate water supplies, stops, and p-traps below accessible lavatories and sinks with molded single piece removable insulation covers, foam, fire resistant, Truebro, or equal. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. Install insulation covers in accordance with CBC access requirements.
- D. Provide threaded shutoff control stop valves with threaded brass nipples at pipe connection on water supplies to each fixture. Provide stops with lock shield loose key and key handle for each stop.
- E. Wall hung fixtures including water closets, urinals, lavatories, and drinking fountains to be supported by floor mounted fixture carriers, with mounting feet securely anchored to floor per carrier manufacturer's recommendations. Fixture carriers to be JR Smith, Mifab, Zurn, Josam, or per fixture manufacturer.
- F. Provide cast brass escutcheons, except escutcheons exposed to view shall have chrome plated finish.
- G. Provide chromium-plated finish on fittings and accessories exposed to view.
- H. Fixture fittings and trim: Conform to ASME A112.18.1M and ASME A112.19.5, as applicable.
- I. Zinc-alloy or plastic handles are not permitted for faucets and valves.
- J. Provide special roughing-in for wheelchair fixtures.
- K. Lavatory flow rates not to exceed 0.5 GPM.
- L. Water closet flush flow rates not to exceed 1.28 GPF.
- M. Urinal flush flow rates not to exceed 0.125 GPF.
- N. Provide water hammer arrestors at end of pipe runs to two or more fixtures, properly sized with sufficient displacement volume to dissipate calculated energy in the piping systems. Locate in accessible location or provide access panel with location approved by Architect.
- O. Fixture dimensions specified are nominal.

## **2.3 SEE PLUMBING SCHEDULE FOR FIXTURE REQUIREMENTS.**

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

#### **3.2 PREPARATION**

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

#### **3.3 INSTALLATION**

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome-plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
- C. Install components level and plumb.
- D. Install and secure fixtures in place with wall carriers and bolts.

#### **3.4 ADJUSTING**

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

#### **3.5 CLEANING**

- A. Clean plumbing fixtures and equipment.

**END OF SECTION**

**SECTION 23 05 10  
MECHANICAL GENERAL PROVISIONS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. References.
- B. Description of Work.
- C. Drawings and Specifications.
- D. Industry Standards and Codes.
- E. Site Examination.
- F. Permits, Fees and Utility Connections.
- G. Coordination of Work.
- H. Progress of Work.
- I. Submittals
- J. Operation and Maintenance Manuals.
- K. Project Record Documents.
- L. Warranty.
- M. Quality and Care
- N. Access Doors.
- O. Starting Equipment and Systems.

**1.2 RELATED SECTIONS**

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 23.

**1.3 REFERENCES**

- A. ANSI - American National Standards Institute.
- B. ASTM - American Society for Testing Materials.
- C. CEC - California Electric Code.
- D. NEMA - National Electric Manufacturers' Association.
- E. NFPA - National Fire Protection Association.
- F. OSHA - Occupational Safety and Health Act.
- G. UL - Underwriters' Laboratories.

- H. See detailed References that are listed in individual sections.

#### **1.4 DESCRIPTION OF WORK**

- A. The work included in this division of the specifications consists of furnishing labor, tools, equipment, supplies and materials, unless otherwise specified, and in performing operations necessary for the installation of the complete Mechanical System as required by these specifications or shown on the Drawings, subject to the terms and conditions of the Contract Agreement.
- B. The work shall also include the completion of details of mechanical work not mentioned or shown which are necessary for the successful operation of mechanical systems described on the drawings or required by these specifications. Furnish and install any incidental work not shown or specified which is required to provide a complete and operational system.

#### **1.5 DRAWINGS AND SPECIFICATIONS**

- A. Drawings are schematic and diagrammatic. Drawings indicate the general arrangement of equipment, piping, ductwork and other mechanical work. Use judgement and care to install mechanical work to fit the job conditions within the building construction and finishes, and to function properly.
- B. The Contractor shall investigate the building conditions affecting the Work and shall arrange his work accordingly providing offsets, fittings, valves and accessories to fit the actual job conditions. The Contractor shall be responsible to field measure and confirm new and existing mechanical systems locations with respect to other architectural, structural, and electrical work, existing and new. Do not scale distances off of the mechanical drawings. Use actual building dimensions.
- C. The drawings and specifications are complimentary each to the other. What is required by one shall be as binding as if called for by both.
- D. Examine all drawings and specifications prior to bidding the Work. Report any discrepancies to the Engineer.

#### **1.6 INDUSTRY STANDARDS AND CODES**

- A. The Mechanical Contractor shall comply with the latest provisions of all codes, regulations, laws and ordinances applicable to the work involved. This does not relieve the Contractor from furnishing and installing work shown or specified which may exceed the requirements of such codes, regulations laws and ordinances.
- B. All materials, products, devices, fixtures forms or types of construction included in this project shall meet or exceed the published requirements of the publications listed below. These publications form a part of this specification.
  - 1. California Building Code, 2022.
  - 2. California Mechanical Code, 2022.
  - 3. California Plumbing Code, 2022.
  - 4. California Electrical Code, 2022.
  - 5. National Fire Protection Association.

6. California Fire Code, 2022.
  7. California State Fire Marshal.
  8. Occupational Safety and Health Administration, including CAL-OSHA.
  9. California Energy Code, 2022.
  10. California Green Building Standards Code, 2022.
  11. State of California Code of Regulations, Title 24.
  12. Other applicable state laws.
- C. Nothing in the Drawings or Specifications shall be construed to permit work that does not conform these codes. When Contract Documents differ from governing codes, furnish and install to the higher standard required at no extra charge. The Contract Documents are not intended to repeat the code requirements except where necessary for clarity.
- D. No material or product installed as a part of the Work shall contain asbestos in any form.

#### **1.7 SITE EXAMINATION**

- A. Contractor shall examine the site, verify dimensions and locations with Drawings, check utility connection locations, and familiarize himself with the existing conditions and limitations. No extras will be allowed because of the Contractor's misunderstanding of the amount of work involved or his lack of knowledge of any site condition which may affect his work. Any apparent variance of the drawings or specifications from the existing conditions at the site shall be called to the attention of the Engineer immediately.

#### **1.8 PERMITS, FEES AND UTILITY SERVICES**

- A. Contractor shall pay for and obtain all permits and service required in the installation of this work.
- B. Contractor shall arrange for all required inspections and will secure approvals from authorities having jurisdiction.

#### **1.9 COORDINATION OF WORK**

- A. It is recognized that the contract documents are diagrammatic in showing certain physical relationships which must be established within the mechanical work, and in its interface with other work and that such establishment is the exclusive responsibility of the contractor.
- B. The Contractor shall give careful consideration to the work of the General, Electrical and other contractors on the job and shall organize his work so that it will not interfere with the work of other trades. He shall consult the drawings and specifications for work of other trades for correcting information, and the pertinent drawings for details and dimensions.
- C. Arrange mechanical work in a neat, well-organized manner with the piping, conduit, and similar services running parallel and/or perpendicular to primary lines of the building construction. Locate operating and control equipment

properly to provide easy access, and arrange entire mechanical work with adequate access for operation and maintenance.

- D. Verify the location of all equipment, and devices, etc. and if interference develops, the Owner/Engineer's decision will be final and no additional compensation will be allowed for the moving of misplaced air devices or equipment.

#### **1.10 PROGRESS OF WORK**

- A. This Contractor shall organize his work so that the progress of the mechanical work will conform to the progress of the other trades, and shall complete the entire installation as soon as the conditions of the building will permit. Any cost resulting from defective or ill timed work performed under this section shall be borne by this Contractor.

#### **1.11 STRUCTURAL DESIGN REQUIREMENTS AND SEISMIC RESTRAINTS**

- A. Mechanical systems and equipment shall be anchored and seismically braced in accordance with all applicable codes and industry standards.
- B. Mechanical systems and equipment shall include, but are not limited to, all piping, heating and ventilating equipment, electrical and control panels, conduits and other components.
- C. For all non-standard installations not detailed in one of the approved systems, the Contractor shall provide details of supports, anchorages and restraints, including attachments to building structure, with supporting calculations all stamped and signed by a licensed professional structural engineer registered in the state in which the Work is performed.

#### **1.12 SUBMITTALS**

- A. See Division 1 for additional submittal procedures.
- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project.
- D. Organize submittals in sequence according to Specification Section. Submit in bound document with tabs identifying each Specification Section. Provide a Table of Contents identifying the Specifications Sections being submitted and the contents within each tabbed section. Prepare Submittals in multiple volumes if required. Provide a complete Submittal package at one time. Do not submit individual Sections piecemeal.
- E. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- F. Furnish, upon request, installation instructions for all equipment and materials to Inspector of Record prior to installation.



- G. Maintain a copy of the fire and smoke damper installation instructions on site for use by the Inspector of Record.

### **1.13 SUBSTITUTION PROCEDURES**

- A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
- B. LP Consulting Engineers, Inc. will consider requests for substitutions only within 7 days after date of Agreement.
- C. Substitutions may be considered when a product becomes unavailable through no fault of the .
- D. Failure by the Contractor to order materials or equipment in a timely manner will not constitute justification for a substitution.
- E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- F. A request for substitution constitutes a representation that the submitter:
  - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
  - 2. Will provide the same warranty for the substitution as for the specified product.
  - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
  - 5. Will reimburse Owner and LP Consulting Engineers, Inc. for review or redesign services associated with reapproval by authorities including obtaining reapproval by authorities.
- G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- H. If excessive review, as judged by the Engineer, is required caused by complicated, numerous or repetitive requests, Contractor shall reimburse Engineer and its Consultants for such review at their standard billing rates.
- I. Substitution Submittal Procedure:
  - 1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
  - 2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
  - 3. The LP Consulting Engineers, Inc. will notify in writing of decision to accept or reject request.
  - 4. Present each substitution individually. If a proposed substitute is not found to be acceptable, then the specified item shall be supplied.

#### **1.14 OPERATION AND MAINTENANCE MANUALS**

- A. See Division 1 for Closeout Submittals for Operation and Maintenance Manual requirements.
- B. Provide operating and maintenance instructions, diagrams and parts lists for all components of all mechanical systems and each piece of equipment furnished under these specifications.
- C. Operating and maintenance instructions shall be furnished for the following equipment and systems:
  - 1. Ventilating Systems.
  - 2. Air Conditioning Systems.
  - 3. Piping Systems.
  - 4. Temperature Controls Systems.
  - 5. Motors.
  - 6. Testing, Adjusting, and Balancing Reports.
- D. Provide manufacturer's model number, design data, capacities, etc. for each piece of mechanical equipment furnished as a part of the Work.
- E. The operating instructions shall include procedures for starting, stopping and emergency manual operation for all equipment and systems.
- F. Provide maintenance instructions of each item of individual equipment including applicable maintenance data as recommended by the manufacturer, including frequency of lubrication, lubricants, inspections required, adjustment procedures, belt and pulley sizes, etc.
- G. Provide manufacturer's parts bulletins with part numbers for each item of equipment included in the Work. Parts bulletins shall be specific to the equipment provided. Extraneous information that does not apply to the equipment provided shall be eliminated from the literature.
- H. Include copies of test reports (startup, check, etc.) and inspections performed for each piece of equipment provided in the Work.
- I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- J. Provide supplier and manufacturer contacts, telephone numbers and addresses in the front portion of the operation and maintenance manual.

#### **1.15 PROJECT RECORD DOCUMENTS**

- A. See Division 1 for Closeout Procedures.
- B. Provide red-lined drawings accurately showing location of equipment and devices and size and routing of ductwork. Include notes explaining installed condition for complete understanding.

#### **1.16 QUALITY ASSURANCE**

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from LP Consulting Engineers, Inc. before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

#### **1.17 PROJECT CONDITIONS**

- A. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

#### **1.18 WARRANTY**

- A. See Division 1 for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.

### **PART 2 PRODUCTS**

#### **2.1 QUALITY AND CARE**

- A. All materials shall be new and in perfect condition when installed unless specifically indicated otherwise. Materials shall be tested within the Continental United States by an independent, nationally recognized testing agency and shall be listed in accordance with testing agency requirements. When not otherwise specified, all material shall conform to applicable National Standards (ANSI).
- B. All capacities, sizes and efficiency ratings shown on the drawing are minimum.
- C. Each category of material or equipment shall be of the same brand or manufacturer throughout the Work wherever possible.
- D. The quality of materials and equipment to be provided is defined by the brand names, manufacturers, model and catalog numbers listed on the Drawings and in the Specifications. Contractor shall provide each item listed, of the quality specified, or equal.
- E. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.
- F. Inspect and report concealed damage to carrier within their required time period.

- G. Store materials in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect from dirt, water, construction debris, and traffic.
- H. Equipment which has been damaged, exposed to weather or is, in the opinion of the Engineer or Owner, otherwise unsuitable because of improper fabrication, storage or installation shall be removed and replaced by this Contractor at his expense.

## **2.2 ACCESS DOORS**

- A. Coordinate access door requirements with Division 1. The more stringent requirements shall govern.
- B. Provide access doors where access through floors, walls or ceilings is required to access mechanical, plumbing, control system components, fire dampers and fire alarm system components (such as smoke detectors, fire/smoke dampers, etc.) or other systems requiring access for maintenance, test or observation.
  - 1. Access doors requiring hand access or access for observation only shall be 14"x14" minimum usable opening.
  - 2. Access doors where entrance of a service person may be required shall be 24"x30" minimum usable opening.
- C. Established standard: Milcor of types listed below. Other acceptable manufacturers: Cesco, J.L. Industries, Karp, Larsen's, or equal. Comply with the following:
  - 1. Form doors and frames of welded, ground smooth steel construction, 14 gauge for doors, 16 gauge for frames. Provide prime coat finish except for stainless steel type.
  - 2. Concealed hinges to allow 175 degree opening.
  - 3. Locks: flush, screw driver operated cam lock(s).
  - 4. Provide anchoring devices suitable for the construction into which the doors are framed.
- D. Application (as applicable):
  - 1. In gypsum drywall walls and ceilings: Type DW.
  - 2. In ceramic tile walls: Type MS (stainless steel).
  - 3. In restroom walls: Type MS (stainless steel with satin finish).
  - 4. In fire rated walls: Type Fire Rated (rating as required for wall or ceiling), self closing, 250 F in 30 min. temperature rating.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Access Doors
  - 1. Coordinate the exact location of access doors to provide proper access to the item concealed. Obtain written approval for access door locations from Architect.
  - 2. Coordinate installation of access doors with the trades performing the construction assemblies into which the access doors are placed.

3. Install all access doors neatly and securely, to open and close completely, and to operate freely and without binding. Install rated doors in accordance with their listing requirements.
4. Test operate all doors and make all adjustments required for satisfactory operation. Replace all damaged materials.
5. Install in accordance with manufacturer's instructions.

### **3.2 FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with the requirements within this section.
- B. Test all piping with no leak or loss in pressure in accordance with the requirements within this section.

### **3.3 GENERAL TESTING REQUIREMENTS FOR MECHANICAL AND PLUMBING SYSTEMS**

- A. Contractor shall assign a responsible person to be an independent representative to witness testing and to sign as witness of times, pressure and losses of testing media for all hydronic piping and duct testing.
  1. Test all piping as noted below with no leak or loss of pressure. Repair or replace defective piping until tests are accomplished successfully.
  2. Submit to the Engineer for review a log of all tests made which shall include time, temperature, pressure, water makeup and other applicable readings, necessary to indicate the systems have been operated and tested in the manner outlined in the construction documents.
  3. After producing the specified test pressure, disconnect the pressurizing source; do not introduce further pressure for the duration of the test period, repair leaky piping and retest. Repeat the procedure until the entire system is proven tight.
- B. Test the following systems with the medium listed to the pressure indicated for the time period listed:
  1. Hydronic Piping: Pressure=125 Psig / Medium= Water / Duration=4 Hours.

### **3.4 CUTTING AND PATCHING**

- A. Submit written request in advance of cutting or alteration which affects:
  1. Structural integrity of any element of Project.
  2. Integrity of weather exposed or moisture resistant element.
  3. Efficiency, maintenance, or safety of any operational element.
  4. Visual qualities of sight exposed elements.
  5. Work of Owner or separate Contractor.
- B. Execute cutting and patching to complete the work, to uncover work to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and

electrical work, to execute patching to complement adjacent work, and to fit Products together to integrate with other work.

- C. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- E. Restore work with new Products in accordance with requirements of Contract Documents.
- F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Code requirements , to full thickness of the penetrated element.
- H. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

### **3.5 PRIMING AND PAINTING**

- A. Apply primer to all exposed ferrous metals that are not factory primed, factory finished, galvanized, stainless steel or anodized. Exposed black steel piping shall be primed and finish painted to match Architectural finish requirements.
  - 1. Primer shall be as recommended by the paint manufacturer for each specific application.
  - 2. Acceptable Products include: Fuller O'Brien Blox-Rust Metal All Purpose Primer, equivalent Rust-Oleum product, or equal. See Section 092216 for other acceptable products.
- B. Apply two coats of primer to metal surfaces of items to be insulated or jacketed, except ductwork and piping, or factory primed or finished.
- C. Preparation:
  - 1. Do not start work until surfaces to be finished are in proper condition to produce finished surfaces of uniform, satisfactory appearance.
  - 2. Stains and Marks: Remove completely, if possible, using materials and methods recommended by coating manufacturer; seal stains and marks which cannot be completely removed using Devco KILSTAIN primers, shellac, or other coating acceptable to paint manufacturer any marks or defects that might bleed through paint finishes.
  - 3. Remove mildew from impervious surfaces by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow substrate to thoroughly dry.
  - 4. Galvanized Surfaces:
    - a. Remove surface contamination and oils by solvent cleaning in accordance with SSPC-SP 1 and allow to dry.

- b. Apply Devoe MIRROLAC Galvanized Metal Primer in accordance with manufacturer instructions.
- 5. Uncoated Steel And Iron Surfaces:
  - a. Remove grease, rust, scale, and dust from steel and iron surfaces using solvent in accordance with SSPC-SP 1.
  - b. Where heavy coatings of scale or contaminants are evident, hand tool clean in accordance with SSPC-SP 2 or use other approved SSPC SP method as needed.
- 6. Shop Primed Steel Surfaces: Remove loose primer and dust. Sand and feather edges to smooth surface. Clean areas with solvent and spot prime bare metal surfaces with appropriate Devoe MIRROLAC metal primer or primer recommended by manufacturer.
- D. Application:
  - 1. Apply each coat to uniform coating thickness in accordance with manufacturer's instructions, not exceeding manufacturer's specified maximum spread rate for indicated surface; thins, brush marks, roller marks, orange-peel, or other application imperfections are not permitted.
  - 2. Allow manufacturer's specified drying time, and ensure correct coating adhesion, for each coat before applying next coat.
  - 3. Remove dust and other foreign materials from substrate immediately prior to applying each coat.

### **3.6 STARTING EQUIPMENT AND SYSTEMS/COMMISSIONING**

- A. Start equipment and systems in accordance with manufacturer's written instructions..
- B. Adjust for proper operation within manufacturer's published tolerances.
- C. Demonstrate proper operation of equipment to Owner's designated representative.
- D. Description:
  - 1. Comply with all start up of mechanical and electrical equipment systems as required in the various sections and herein.
  - 2. Coordinate all testing and startup procedures with all other trades so that all non-mechanical and non-electrical work is completed and operational so that the specified testing can be performed.
- E. Preliminary Work:
  - 1. Prior to the startup, the Contractor shall ensure that the systems are ready to operate, and the following items have been completed and checked including but not limited to:
    - a. Proper motor and pump rotation.
    - b. Flushing and cleaning of the system.
    - c. Wiring
    - d. Auxiliary connections
    - e. Lubrication.

- f. Venting.
    - g. Controls.
    - h. Installation of filters and strainers.
    - i. Setting of relief and safety valves .
  - 2. All electrical testing must be completed and test results submitted before equipment startup to avoid power interruptions during mechanical equipment startup and testing.
  - 3. The Contractor shall submit at least 10 days in advance a schedule listing the date of completion of his work as it will be ready for equipment startup of Electrical/Mechanical equipment. This schedule shall include work on a system by system, floor by floor basis.
  - 4. Two weeks prior to the startup of any major equipment, the Contractor shall certify in writing that the systems will be complete and ready for startup. Completeness shall not only include physical installation of individual pieces of equipment, but all related elements of other crafts to make all equipment operate as a system.
    - a. The startup checklist will cover all related crafts, e.g., controls, electrical, mechanical, and a clean environment for equipment startup.
  - 5. The Contractor shall schedule a tour with the Owner's representative and the Engineer to review startup conditions prior to equipment startup. This tour shall take place during the associated Engineer's regularly scheduled visit. This tour does not relieve the Contractor of any responsibilities to properly start equipment. The Engineer will issue a notice of deficiencies that will be required to be corrected prior to equipment startup. The Contractor will be required to reschedule a back check with the Engineer prior to attempting an equipment startup.
  - 6. Equipment of systems should not be started until systems and associated subsystems are completed. Verify that other continuing work could not possibly damage completed systems if they are in operation. Furnish signed off prestartup check sheet.
- F. Startup and Commissioning:
- 1. System Startup and Operation:
    - a. The Contractor shall provide all labor, materials and services necessary for the initial startup and operation of all systems and equipment furnished and installed under this section.
    - b. The Contractor and the factory representative shall check all equipment during initial startup to insure correct rotation, proper lubrication, adequate fluids or air flows, nonoverloading electrical characteristics, proper alignment and vibration isolation. Systems shall be checked for air and/or water flows throughout without blockages. Air handling systems shall be checked for proper damper connections and positions, aligned and adjusted belt drives, proper lubrication, temporary air filters installed, nonexcessive electrical characteristics and minimal vibration. Other miscellaneous



equipment shall be started and operated as described above as applicable. Manufacturer's representative shall submit a preliminary written copy of equipment startup check sheet prior to leaving job site.

- c. After initial startup and operation of systems, the Contractor shall submit a report, showing proper operation before commencement of the final "Operation Test".
- d. During initial operation of the system and until substantial completion, qualified personnel shall be provided and designated for maintaining the equipment and systems in good running order. Items such as strainers, cleanouts, filter replacement, bearing lubrication, packing replacement, and other consumables shall be provided without cost to the Owner. Failure of equipment during this period due to lack of proper supervision is the responsibility of the Contractor and continued failures shall be grounds for the Owner to provide such services with back charges to the Contractor. Submit written schedule of completed maintenance to the Engineer.

G. System Acceptance:

- 1. General: The system installation shall be complete and tested for proper operation prior to acceptance testing "Operation Test" for the Owners authorized representative. A letter shall be submitted to the Engineer requesting system acceptance. This letter shall certify that all controls are installed and the software programs have been completely exercised for proper equipment operation. Acceptance testing shall commence at a mutually agreeable time within ten (10) calendar days of request. When the field test procedures have been demonstrated to the Owner's representative and pass, the system will be accepted. The warranty period may begin at this time.
- 2. A certified acceptance test technician (ATT) shall perform and document acceptance testing as applicable per Title 24 sections 120.5 and 130.4. Certificate of Acceptance shall be in PDF format for electronic submission to Authority Having Jurisdiction.

H. Operation Test:

- 1. Provide all labor, equipment, and materials required to perform test.
- 2. The test shall occur after all major equipment startup and balance services have been performed as specified. The purpose is to demonstrate that individual pieces of equipment and all related elements operate as one complete system and not to identify incomplete or defective work.
- 3. All equipment is to be run in an automatic operating position and exercised for 72 hours to verify that they perform in accordance with the specified sequence of operation and designed operation logic.

4. The Engineer's representative shall be notified and may be present for the initiation of the test.
5. A log shall be prepared by the Contractor, to be submitted to the Engineer, of all tests including, but not limited to: time, temperatures, pressures, and other readings to prove all equipment is operating as specified.
6. All temperatures, pressures, status indication, etc., shall be verified by at least one other means of measurement or visual verification of condition.
7. Change set points and simulate conditions as directed to demonstrate:
  - a. Ability to control to new set point.
  - b. Interface between systems, fire alarm/fire sprinkler systems.
  - c. Proper sequence and operation.
  - d. Equipment safety systems and all automatic changeover/backup systems and alarms are functioning or will function.
8. If unsatisfactory performance or a system failure is experienced for any reason, the test shall be repeated until 72 hour consecutive hours are achieved. The Engineer's representative shall make all final decisions of a satisfactory test.

**END OF SECTION**

**SECTION 23 05 29**  
**HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Strut systems for pipe or equipment support.
- B. Beam clamps.
- C. Pipe hangers.
- D. Pipe rollers and roller supports.
- E. Pipe supports, guides, shields, and saddles.
- F. Seismic bracing hardware.
- G. Nonpenetrating rooftop supports for low-slope roofs.
- H. Anchors and fasteners.

**1.2 REFERENCE STANDARDS**

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).
- F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).
- H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
- J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
- K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

Hangers and Supports for HVAC Piping and  
Equipment

- L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
- M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).
- N. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

### **1.3 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
- C. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

## **PART 2 PRODUCTS**

### **2.1 GENERAL REQUIREMENTS**

- A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of mechanical work.
- B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.
- C. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
- D. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
- E. Fire Resistance: Provide hardware rated for 120 minutes resistance unless specifically indicated by the authority having jurisdiction.
- F. Materials for Metal Fabricated Supports: Comply with Section 05 50 00.
  - 1. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.
- G. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.
  - 1. Indoor Dry Locations: Use approved equivalent or galvanized steel unless otherwise indicated.

Hangers and Supports for HVAC Piping and  
Equipment

2. Outdoor, Damp, or Wet-Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.

## **2.2 STRUT SYSTEMS FOR PIPE OR EQUIPMENT SUPPORT**

- A. Strut Channels:
  1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
  2. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.
- B. Hanger Rods:
  1. Threaded zinc-plated steel unless otherwise indicated.
  2. Minimum Size, Unless Otherwise Indicated or Required:
    - a. Equipment Supports: 3/8 inch diameter.
    - b. Piping up to 4 inch: 3/8 inch diameter.
    - c. Piping larger than 4 inch: 1/2 inch diameter.
    - d. Trapeze Support for Multiple Pipes: 3/8 inch in length.
- C. Channel Nuts:
  1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring as indicated on drawings.

## **2.3 BEAM CLAMPS**

- A. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
- B. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
- C. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

## **2.4 PIPE HANGERS**

- A. J-Hangers, Adjustable:
  1. MSS SP-58 type 5, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
  2. Felt-Lined: Provide for uninsulated pipe to reduce noise and prevent static issues.
- B. Swivel Ring Hangers, Adjustable:
  1. MSS SP-58 type 10, epoxy-painted, zinc-colored.
  2. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
  3. Felt-Lined: Provide for uninsulated pipe to reduce noise and prevent static issues.
- C. Clevis Hangers, Adjustable:

Hangers and Supports for HVAC Piping and  
Equipment

1. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.
2. Felt-Lined: MSS SP-58 type 1, zinc-plated, silicone-free carbon steel.
3. Light-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.
4. Standard-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.

## **2.5 PIPE CLAMPS**

- A. Riser Clamps:
  1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
  2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
  3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
  4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.
- B. Extension Split Pipe Clamp:
  1. MSS SP-58 type 12, hinged split ring and yoke roller hanger with epoxy copper or plain finish.
  2. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
  3. Provide hanger rod and nuts of the same type and material for a given pipe run.
  4. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
- C. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.
- D. Strut Clamps:
  1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.
  2. Cushioned Pipe or Tubing Strut Clamp: Provide strut clamp with thermoplastic elastomer cushion having dielectric strength of 670 V/mil.
- E. Insulation Coupling:
  1. Two bolt-type clamps designed for installation under insulation.
  2. Material: Carbon steel with epoxy copper or zinc finish.

## **2.6 PIPE ROLLERS AND ROLLER SUPPORTS**

- A. MSS SP-58 type 43 based on required load, nonconductive and corrosion resistant.
- B. Steel Yoke Type: MSS SP-58 type 44, vertically adjustable, nonconductive, and corrosion resistant.
- C. Material: Zinc plated ASTM A36/A36M carbon steel or ASTM A47/A47M malleable iron.

## **2.7 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES**

Hangers and Supports for HVAC Piping and  
Equipment

- A. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.
- B. Stanchions:
  - 1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
  - 2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.
  - 3. For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.
- C. U-Bolts:
  - 1. MSS SP-58 type 24, carbon steel u-bolt for pipe support or anchoring.
- D. Pipe Alignment Guides, Galvanized steel:
  - 1. Pipe Sizes 8 inch and Smaller: Spider or sleeve type.
  - 2. Pipe Sizes 10 inch and Larger: Roller type.
- E. Pipe Shields for Insulated Piping:
  - 1. MSS SP-58 type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
  - 2. General Construction and Requirements:
    - a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
    - b. Shields Material: UV-resistant polypropylene with glass fill.
    - c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
    - d. Service Temperature: Minus 40 to 178 degrees F.
    - e. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
- F. Pipe Supports:
  - 1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
  - 2. Liquid Temperatures Up to 122 degrees F:
    - a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.
    - b. Support From Below: MSS SP-58 types 35 through 38.
  - 3. Operating Temperatures from 122 to 446 degrees F:
    - a. Overhead Support: MSS SP-58 type 1 or 3 through 12 clamps with appropriate saddle of MSS SP-58 type 40 for insulated pipe.
    - b. Roller Chair: MSS SP-58 types 41 or 43 through 46 roller chair support with appropriate saddle of MSS SP-58 type 39 for insulated pipe.
    - c. Sliding Support: MSS SP-58 types 35 through 38.
- G. Pipe Supports, Thermal Insulated:

1. General Requirements:
  - a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
  - b. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.
  - c. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
  - d. Provide pipe supports for 1/2 to 30 inch iron pipes.
  - e. Insulation inserts to consist of rigid phenolic foam insulation surrounded by 360 degree, PVC jacketing.
2. PVC Jacket:
  - a. Pipe insulation protection shields to be provided with ball bearing hinge and locking seam.
  - b. Minimum Service Temperature: Minus 40 degrees F.
  - c. Maximum Service Temperature: 180 degrees F.
  - d. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
  - e. Minimum Thickness: 60 mil, 0.06 inch.

## **2.8 SEISMIC BRACING HARDWARE**

- A. Cable Sway Bracing Systems:
  1. Cable wire hanger with fix and release spring mechanism enclosed using zinc housing with 302 stainless steel components for pipe or equipment suspension to surface-mounted end-fixing fittings.
  2. Provide cable wire and end-fixing as required to hold minimum weight of 100 lb.
- B. NONPENETRATING ROOFTOP SUPPORTS FOR LOW-SLOPE ROOFS
- C. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
- D. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
- E. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
- F. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
- G. ANCHORS AND FASTENERS
- H. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

Hangers and Supports for HVAC Piping and  
Equipment



- I. Concrete: Use preset concrete inserts or expansion anchors.
- J. Solid or Grout-Filled Masonry: Use expansion anchors.
- K. Hollow Masonry: Use toggle bolts.
- L. Hollow Stud Walls: Use toggle bolts.
- M. Steel: Use beam clamps, machine bolts, or welded threaded studs.
- N. Sheet Metal: Use sheet metal screws.
- O. Wood: Use wood screws.
- P. Plastic and lead anchors are not permitted.
- Q. Powder-actuated fasteners are not permitted.
- R. Hammer-driven anchors and fasteners are not permitted.
- S. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
- T. Preset Concrete Inserts: Continuous metal strut channel and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
  - 1. Channel Material: Use galvanized steel.
  - 2. Manufacturer: Same as manufacturer of metal strut channel framing system.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

#### **3.2 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- D. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

- G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
- H. Equipment Support and Attachment:
  - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
  - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
  - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- I. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.
- J. Secure fasteners according to manufacturer's recommended torque settings.
- K. Remove temporary supports.

### **3.3 FIELD QUALITY CONTROL**

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

**END OF SECTION**

**SECTION 23 05 53**  
**IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Ceiling tacks.

**1.2 RELATED REQUIREMENTS**

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

**1.3 REFERENCE STANDARDS**

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

**1.4 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

**PART 2 PRODUCTS**

**2.1 IDENTIFICATION APPLICATIONS**

- A. Air Handling Units: Nameplates.
- B. Air Terminal Units: Nameplates.
- C. Control Panels: Nameplates.
- D. Fire and/or Smoke Dampers: Ceiling tacks, where located above lay-in ceiling.
- E. Heat Transfer Equipment: Nameplates.
- F. Major Control Components: Nameplates.
- G. Piping: Pipe markers.
- H. Pumps: Nameplates.
- I. Small-sized Equipment: Tags.
- J. Tanks: Nameplates.

Identification for HVAC Piping and  
Equipment  
23 05 53 - 1

- K. Thermostats: Nameplates.
- L. Valves: Tags and ceiling tacks where located above lay-in ceiling.

## **2.2 MANUFACTURERS**

- A. Brady Corporation: [www.bradycorp.com](http://www.bradycorp.com).
- B. Seton Identification Products: [www.seton.com/aec](http://www.seton.com/aec).

## **2.3 NAMEPLATES**

- A. Description: Laminated three-layer plastic with engraved letters.
  - 1. Letter Color: White.
  - 2. Letter Height: Air Handling Units, Control panels: 1 inch.
  - 3. Letter Height: All others: 1/4 inch.
  - 4. Background Color: Black.
  - 5. Plastic: Comply with ASTM D709.

## **2.4 TAGS**

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

## **2.5 PIPE MARKERS**

- A. Color: Comply with ASME A13.1.
- B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Secure to pipe using two (2) bands of adhesive tape with flow arrows supplied by the manufacturer. Install securing bands completely around pipe and overlapped.
- C. Underground Plastic Pipe Markers: Bright-colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

## **2.6 CEILING TACKS**

- A. Description: Steel with 3/4 inch diameter color coded head.
- B. Color code as follows:
  - 1. Fire Dampers and Smoke Dampers: Red.
  - 2. Heating/Cooling Valves: Blue.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Degrease and clean surfaces to receive adhesive for identification materials.

### **3.2 INSTALLATION**

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- D. Identify fans and filter boxes with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- E. Identify chilled/hot water equipment, including chillers, boilers, pumps, expansion tanks, air separators, etc. with plastic nameplates.
- F. Identify air conditioning units, air handling units, heating and ventilating units, exhaust fans, pumps, heat transfer equipment, tanks, fire/smoke damper access doors, and water treatment devices with nameplates. Small devices, such as terminal units, in-line pumps, may be identified with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify thermostats/sensors relating to fan unit and/or zone unit with nameplates.
- I. Identify valves in main and branch piping with tags.
- J. Identify piping, concealed or exposed, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- K. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

**END OF SECTION**

**SECTION 23 05 93**  
**TESTING, ADJUSTING, AND BALANCING FOR HVAC**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Testing, adjustment, and balancing of air systems.

**1.2 RELATED REQUIREMENTS**

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

**1.3 REFERENCE STANDARDS**

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008, with Errata (2019).
- C. NEBB (TAB) - Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems; 2019, with Errata (2022).
- D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2023.

**1.4 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component and include controls contractor to assist in testing, adjusting, and balancing procedures. Submit plan for each phase.
  - 1. Submit to LP Consulting Engineers, Inc..
  - 2. Submit to the Commissioning Authority.
  - 3. Submit four weeks prior to starting the testing, adjusting, and balancing work.
  - 4. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the LP Consulting Engineers, Inc. and other installers to sufficiently understand the design intent for each system.
  - 5. Include at least the following in the plan:
    - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
    - b. List of all air flow measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
    - c. Completed planned test sheets listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
    - d. Single-line drawings with system test locations.

- e. Identification and types of measurement instruments to be used and their most recent calibration date.
  - f. Detailed step-by-step procedures for TAB work for each system and issue, including:
    - 1) SA, RA, EA, OA, for each AHU.
    - 2) Economizer proportioning and vfd speed adjustments.
    - 3) Rechecking.
  - g. Confirmation of understanding of the outside air ventilation criteria under all conditions.
  - h. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
  - i. Method of checking building static and exhaust fan and/or relief damper capacity.
  - j. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
- C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- 1. Submit to LP Consulting Engineers, Inc. within 2 days after completion of testing, adjusting, and balancing.
  - 2. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
  - 3. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
  - 4. Units of Measure: Report data in I-P (inch-pound) units only.
  - 5. Test Reports: Indicate data on AABC MN-1 forms, forms prepared following ASHRAE Std 111, or NEBB forms.
  - 6. Include the following on the title page of each report:
    - a. Name of Testing, Adjusting, and Balancing Agency.
    - b. Address of Testing, Adjusting, and Balancing Agency.
    - c. Telephone number of Testing, Adjusting, and Balancing Agency.
    - d. Project name.
    - e. Project location.
    - f. Project Engineer.
    - g. Project altitude.
    - h. Report date.
- D. Test and balance shall be performed by an independent test and balance agency.
- E. Perform total system balance in accordance with AABC MN-1, ASHRAE Std 111, or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

- F. TAB Agency Qualifications: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years documented experience certified by AABC or NEBB.
- G. Perform Work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor experienced in performance of this Work and licensed at the .

## **PART 2 PRODUCTS - NOT USED**

## **PART 3 EXECUTION**

### **3.1 GENERAL REQUIREMENTS**

- A. Perform total system balance in accordance with one of the following:
  - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
  - 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
  - 3. SMACNA (TAB).
- B. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- C. TAB Agency Qualifications:
  - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
  - 2. Having minimum of three years documented experience.
  - 3. Certified by one of the following:
    - a. AABC, Associated Air Balance Council: [www.aabc.com/#sle](http://www.aabc.com/#sle); upon completion submit AABC National Performance Guaranty.
    - b. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: [www.tabbcertified.org/#sle](http://www.tabbcertified.org/#sle).
- D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

### **3.2 TESTING, ADJUSTING, AND BALANCING AGENCIES**

- A. RS Analysis Inc.; [www.rsanalysis.com](http://www.rsanalysis.com); (888-330-1935).
- B. Mesa 3; [www.mesa3.com](http://www.mesa3.com); (408-928-3000).
- C. Raglen System Balance; [www.raglensystembalance.com](http://www.raglensystembalance.com); (775-747-0100).
- D. National Air Balance Company Inc.; [www.nabco.biz](http://www.nabco.biz); (510-623-7000).

### **3.3 EXAMINATION**

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
  - 1. Systems are started and operating in a safe and normal condition.
  - 2. Temperature control systems are installed complete and operable.



3. Final filters are clean and in place. If required, install temporary media in addition to final filters.
  4. Duct systems are clean of debris.
  5. Fans are rotating correctly.
  6. Fire and volume dampers are in place and open.
  7. Air coil fins are cleaned and combed.
  8. Access doors are closed and duct end caps are in place.
  9. Air outlets are installed and connected.
  10. Hydronic systems are flushed, filled, and vented.
  11. Pumps are rotating correctly.
  12. Proper strainer baskets are clean and in place.
  13. Service and balance valves are open.
- B. Contractor to inspect ductwork and piping systems at 60% and 90% completion to verify systems are ready for testing and balancing.
- C. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- D. Beginning of work means acceptance of existing conditions.

### **3.4 PREPARATION**

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to LP Consulting Engineers, Inc. to facilitate spot checks during testing.
- B. Provide additional balancing devices as required.

### **3.5 ADJUSTMENT TOLERANCES**

- A. Air Handling Systems: Adjust total airflow(s) to within plus 10 percent and minus 5 percent of design.
- B. Air Outlets and Inlets: Adjust outlets and inlets in space to within plus 10 percent and minus 10 percent of design.
- C. Ventilation Systems: Adjust outside air system components to within plus 10 percent and minus 0 percent of design.
- D. Hydronic Systems: Adjust to within plus 10 percent and minus 5 percent of design.

### **3.6 RECORDING AND ADJUSTING**

- A. Field Logs: Maintain written logs including:
1. Running log of events and issues.
  2. Discrepancies, deficient or uncompleted work by others.
  3. Contract interpretation requests.
  4. Lists of completed tests.
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

- D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.

### **3.7 AIR SYSTEM PROCEDURE**

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- E. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- F. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- G. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

### **3.8 TITLE 24 TESTING**

- A. Complete applicable Title 24 Acceptance Testing as delineated in contract drawings.

### **3.9 COMMISSIONING**

- A. See Division 1, 22, 23 and 26 Commissioning specifications for requirements. Coordinate all requirements with Commissioning Agent.
- B. Perform prerequisites prior to starting commissioning activities.
- C. Assist Commissioning Agent in field verification of test and balance report.
- D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

### **3.10 SCOPE**

- A. Test, adjust, and balance the following:
  - 1. Air Handling Units.
  - 2. Fans.
  - 3. Air Filters.
  - 4. Air Inlets and Outlets.

### **3.11 MINIMUM DATA TO BE REPORTED**

- A. Electric Motors:
  - 1. Manufacturer.
  - 2. Model/Frame.
  - 3. HP/BHP.
  - 4. Phase, voltage, amperage; nameplate, actual, no load.
  - 5. RPM.
  - 6. Service factor.
  - 7. Starter size, rating, heater elements.
  - 8. Sheave Make/Size/Bore.
- B. Cooling Coils:
  - 1. Location.
  - 2. Service.
  - 3. Manufacturer.
  - 4. Air flow, design and actual.
  - 5. Entering air DB temperature, design and actual.
  - 6. Entering air WB temperature, design and actual.
  - 7. Leaving air DB temperature, design and actual.
  - 8. Leaving air WB temperature, design and actual.
  - 9. Saturated suction temperature, design and actual.
  - 10. Air pressure drop, design and actual.
- C. Air Moving Equipment:
  - 1. Location.
  - 2. Manufacturer.
  - 3. Model number.
  - 4. Serial number.
  - 5. Arrangement/Class/Discharge.
  - 6. Air flow, specified and actual.
  - 7. Return air flow, specified and actual.
  - 8. Outside air flow, specified and actual.
  - 9. Total static pressure (total external), specified and actual.
  - 10. Inlet pressure.
  - 11. Discharge pressure.
  - 12. Sheave Make/Size/Bore.
  - 13. Number of Belts/Make/Size.
  - 14. Fan RPM.
- D. Return Air/Outside Air/Exhaust Air:
  - 1. Identification/location.
  - 2. Design air flow (determined by initial test)
  - 3. Actual air flow.
  - 4. Design return air flow (determined by initial test)
  - 5. Actual return air flow.
  - 6. Design outside air flow (determined by initial test)

7. Actual outside air flow.
  8. Return air temperature.
  9. Outside air temperature.
  10. Actual mixed air temperature.
- E. Duct Traverses:
1. System zone/branch.
  2. Duct size.
  3. Area.
  4. Design velocity.
  5. Design air flow.
  6. Test velocity.
  7. Test air flow.
  8. Duct static pressure.
  9. Air temperature.
  10. Air correction factor.

**END OF SECTION**

## **SECTION 23 07 13 DUCT INSULATION**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Duct insulation.
- B. Duct liner.
- C. Jacketing and accessories.

#### **1.2 RELATED REQUIREMENTS**

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 23 31 00 - HVAC Ducts and Casings: Ductwork.

#### **1.3 REFERENCE STANDARDS**

- A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- E. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
- F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- G. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
- J. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
- K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

#### **1.4 RELATED SECTIONS**

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.

- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 23.

#### **1.5 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

#### **1.6 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

#### **1.8 FIELD CONDITIONS**

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

### **PART 2 PRODUCTS**

#### **2.1 REGULATORY REQUIREMENTS**

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

#### **2.2 GLASS FIBER, FLEXIBLE**

- A. Manufacturer:
  - 1. Owens-Corning Fiberglas; Model [All Service Faced Duct Wrap].
  - 2. Knauf Insulation: [www.knaufinsulation.com](http://www.knaufinsulation.com).
  - 3. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
- B. Insulation: ASTM C553; flexible, noncombustible blanket.

1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
  2. Duct Application: 2" thick, 3/4 pound density.
  3. Maximum Water Vapor Absorption: 5.0 percent by weight.
- C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
  2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
  3. Secure with pressure-sensitive tape.
- D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

## **2.3 GLASS FIBER, RIGID**

- A. Manufacturer:
1. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  2. Knauf Insulation: [www.knaufinsulation.com](http://www.knaufinsulation.com).
  3. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
  4. Owens Corning Corporation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
- B. Insulation: ASTM C612; rigid, noncombustible blanket.
1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
  2. Maximum Service Temperature: 450 degrees F.
  3. Maximum Water Vapor Absorption: 5.0 percent.
  4. Density: 3.0 lb/cu ft.
- C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
  2. Secure with pressure-sensitive tape.
- D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

## **2.4 JACKETING AND ACCESSORIES**

- A. Aluminum Jacket:
1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
  2. Thickness: 0.020 inch sheet.
  3. Finish: Embossed.
  4. Joining: Longitudinal slip joints and 2 inch laps.
  5. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
  6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

## **2.5 DUCT LINER**

- A. Manufacturers:
  - 1. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 2. Knauf Insulation: [www.knaufinsulation.com](http://www.knaufinsulation.com).
  - 3. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
  - 4. Owens Corning Corp: [www.owenscorning.com](http://www.owenscorning.com).
- B. Insulation: Incombustible glass fiber complying with ASTM C 1071; flexible blanket; impregnated surface and edges coated with acrylic polymer shown to be fungus and bacteria resistant by testing to ASTM G 21.
  - 1. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
  - 2. Duct Application (Indoors): 1" thick, 1-1/2 pound density.
  - 3. Duct Application (Outdoors): 2" thick, 1-1/2 pound density.
  - 4. Service Temperature: Up to 250 degrees F.
  - 5. Acoustical Requirements
    - a. Sound absorption coefficients of the material (with and/or without erosion resistive coating) shall be greater than or equal to the coefficients listed in the specifications when tested under the specified conditions.
    - b. All acoustical measurements shall be performed in accordance with ANSI/ASTM C423 and shall be performed in the ASTM E795 mounting configuration as indicated.
    - c. An independent acoustical laboratory shall perform the tests.
    - d. The sound absorption coefficient provided by the material shall meet or exceed the following values in each octave band listed:
  - 6. Thickness, 1 inch Hz/Coefficient: 125/.05, 250/.20, 500/.65, 1k/.90, 2k/.95, 4k/.95.
- C. Liner Fasteners: Galvanized steel, welded with integral head.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Test ductwork for design pressure prior to applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

### **3.2 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Prime and paint exposed ductwork as required by Architect.
- C. Insulated Ducts Conveying Air Below Ambient Temperature:
  - 1. Provide insulation with vapor barrier jackets.
  - 2. Finish with tape and vapor barrier jacket.
  - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
  - 4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.



- D. Insulated Ducts Conveying Air Above Ambient Temperature:
  - 1. Provide with or with standard vapor barrier jacket.
  - 2. Finish with tape and vapor barrier jacket.
  - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
  - 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- E. Duct and Plenum Liner Application:
  - 1. Adhere insulation with adhesive for 100 percent coverage.
  - 2. Secure insulation with mechanical liner fasteners. Liner shall start within 3 inches of the upstream transverse edges of the liner and 3 inches from the longitudinal joints, and shall be spaced at a maximum of 12 inches on center around the perimeter of the duct (except that they shall be a maximum of 12 inches from a corner break). Elsewhere, they shall be a maximum of 18 inches on center, except that they shall not be placed more than 6 inches from a longitudinal joint of the liner or 12 inches from a corner break. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for spacing.
  - 3. Seal and smooth joints. Seal and coat transverse and longitudinal joints.
  - 4. Seal liner surface penetrations with adhesive.
  - 5. Duct dimensions indicated are inside dimensions and do not include consideration for liner thickness.

### **3.3 SCHEDULES**

- A. Supply and Return Ducts: Insulate all unlined ducts, except ducts exposed in conditioned spaces.
- B. Exterior Applications:
  - 1. Supply and Return Ducts exposed to outdoors to be internally lined except ductwork conveying direct evaporatively cooled air.
  - 2. Supply and Return ductwork exposed to outdoors for direct evaporatively cooling systems to be externally insulated. Cover insulation with with calked aluminum jacket with seams located on bottom side of horizontal duct section.
- C. Supply and Return Ducts: Install lining within 10 feet of fan on all ductwork and where shown on drawings where longer lining lengths has been shown.

### **END OF SECTION**

**SECTION 23 07 19**  
**HVAC PIPING INSULATION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Piping insulation.
- B. Jacketing and accessories.

**1.2 RELATED REQUIREMENTS**

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 23 21 13 - Hydronic Piping: Placement of hangers and hanger inserts.
- C. Section 23 23 00 - Refrigerant Piping: Placement of inserts.

**1.3 REFERENCE STANDARDS**

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- C. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2017 (Reapproved 2023).
- D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.
- E. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.
- F. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2022.
- G. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).
- H. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.
- I. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.
- J. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2019.
- K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- L. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
- M. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

- N. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
- O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

#### **1.4 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

#### **1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

#### **1.7 FIELD CONDITIONS**

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

### **PART 2 PRODUCTS**

#### **2.1 REGULATORY REQUIREMENTS**

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

#### **2.2 GLASS FIBER, RIGID**

- A. Manufacturers:
  - 1. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).
  - 2. Johns Manville Corporation: [www.jm.com/#sle](http://www.jm.com/#sle).
  - 3. Knauf Insulation: [www.knaufusa.com](http://www.knaufusa.com).
  - 4. Owens Corning Corporation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
  - 1. "K" value: ASTM C 177:
    - a. 0.24 to 0.28 at 100 degrees mean rating temperature.
    - b. 0.25 to 0.29 at 125 degrees mean rating temperature.
    - c. 0.27 to 0.30 at 150 degrees mean rating temperature.

- d. 0.29 to 0.31 at 200 degrees mean rating temperature.
  - e. 0.32 to 0.34 at 250 degrees mean rating temperature.
- 2. Maximum Service Temperature: 850 degrees F.
- 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
- D. Vapor Barrier Lap Adhesive: Compatible with insulation.

## **2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION**

- A. Manufacturers:
  - 1. Armacell LLC: [www.armacell.us/#sle](http://www.armacell.us/#sle).
  - 2. K-Flex USA LLC: [www.kflexusa.com/#sle](http://www.kflexusa.com/#sle).
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
  - 1. Minimum Service Temperature: Minus 40 degrees F.
  - 2. Maximum Service Temperature: 180 degrees F.
  - 3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.
- D. Weather Barrier Coating: Air dried, contact adhesive, compatible with insulation and ASTM E84 compliant.
- E. Insulation Exposed to the Weather: Finish with two coats Armstrong white Armaflex finish. Provide aluminum jacketing.

## **2.4 JACKETING AND ACCESSORIES**

- A. PVC Plastic.
  - 1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
    - a. Minimum Service Temperature: 0 degrees F.
    - b. Maximum Service Temperature: 150 degrees F.
    - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
    - d. Thickness: 10 mil, 0.010 inch.
    - e. Connections: Brush on welding adhesive.
- B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
  - 1. Thickness: 0.016 inch sheet.
  - 2. Finish: Embossed.
  - 3. Joining: Longitudinal slip joints and 2 inch laps.
  - 4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
  - 5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

### **3.2 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Inserts and Shields:
  - 1. Application: Piping 1-1/2 inches diameter or larger.
  - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
  - 3. Insert location: Between support shield and piping and under the finish jacket.
  - 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
  - 5. Insert material: Pipe saddle.
- D. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 84 00.
- E. Pipe Exposed in Mechanical Closets or Finished Spaces: Finish with PVC jacket and fitting covers.
- F. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

### **3.3 SCHEDULE**

- A. Cooling Systems:
  - 1. Refrigerant Suction:
    - a. Flexible Elastic Cellular Insulation:
      - 1) Pipe Size Range: 3/4 inch and smaller.
        - (a) Thickness: 1 inch.
      - 2) Pipe Size Range: 1 inch and larger.
        - (a) Thickness: 1.5 inch.
  - 2. Refrigerant Hot Gas:
    - a. Flexible Elastic Cellular Insulation:
      - 1) Pipe Size Range: 3/4 inch and smaller.
        - (a) Thickness: 1 inch.
      - 2) Pipe Size Range: 1 inch and larger.
        - (a) Thickness: 1.5 inch.

**END OF SECTION**

**SECTION 23 08 00**  
**MECHANICAL COMMISSIONING REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The purpose of this section is to specify the Contractor's responsibilities and participation in the commissioning process relative to division 23.
- B. The commissioning process is primarily the responsibility of the Commissioning Authority, with support for start-up, testing, and commissioning the responsibility of the Contractors. The commissioning process does not relieve the Contractor from participation in the process or diminish the role and obligations to complete all portions of work in a satisfactory and fully operational manner.
- C. Work of Division 23 includes:
  - 1. Testing and start-up of the mechanical equipment.
  - 2. Assistance in functional testing to verify equipment/ system performance.
  - 3. Providing qualified personnel to assist in commissioning tests, including seasonal testing.
  - 4. Completion and endorsement of pre-functional test checklists provided by the Commissioning Authority to assure that Division 23 equipment and systems are fully operational and ready for functional testing.
  - 5. Providing equipment, materials, and labor necessary to correct deficiencies found during the commissioning process which fulfill contract and warranty requirements.
  - 6. Providing training for the systems specified in Division 23 with coordination of owner.

**1.2 RELATED WORK**

- A. All testing and start-up procedures and documentation requirements specified within Division 23.
- B. Section 01 9100 – General Commissioning Requirements
- C. Section 26 0800 – Electrical Commissioning Requirements
- D. Section 22 08 00 - Plumbing Commissioning Requirements
- E. Commissioning functional test procedures that require participation of the Contractors.
- F. Cooperate with the Commissioning Authority in the following manner:
  - 1. Allow sufficient time before final completion dates so that test and balance and commissioning testing can be accomplished.
  - 2. Provide labor and material to make corrections when required without undue delay.
  - 3. Put all heating, ventilating, and air conditioning systems and equipment into full operation and continue the operation of the same during each working day of commissioning.

## **PART 2 - PRODUCTS**

### **2.1 TEST EQUIPMENT**

- A. Standard certified test equipment for commissioning shall be provided by the TAB Contractor.
- B. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist the Commissioning Authority in the commissioning process.

## **PART 3 - EXECUTION**

### **3.1 WORK PRIOR TO COMMISSIONING**

- A. Complete all phases of work so the system can be started, tested, balanced, and otherwise commissioned. Division 23 has primary start-up responsibilities with obligations to complete systems, including all sub-systems so they are functional. This includes the complete installation of all equipment, materials, pipe, duct, wire, insulation, controls, etc., per the contract documents and related directives, clarifications, change orders, etc.
- B. The Commissioning Authority will develop a Commissioning Plan. Upon request of the Commissioning Authority, the Contractor shall provide assistance and consultation. The Commissioning Plan will be developed prior to completion of the installation. The Contractor is obligated to assist the Commissioning Authority in preparing the Commissioning Plan by providing all necessary information pertaining to the actual equipment and installation.
- C. Specific pre-commissioning responsibilities of Division 23 are as follows:
  - 1. Normal start-up services required to bring each system into a fully operational state. This includes motor rotational check, cleaning, filling, purging, control sequences of operation, leak testing, full-load and part-load performance, etc. The Commissioning Authority will not begin the commissioning process until each system is complete and documented, including normal contractor start-up.
  - 2. The Contractor shall perform pre-functional tests on the equipment and systems as noted in section 01 9100 General Commissioning Requirements.
  - 3. Contractor start-up forms may be substituted for the pre-functional test forms with prior approval by the Commissioning Authority.
  - 4. Pre-functional test forms will be kept in the Contractors job trailer in a Commissioning Field Notebook provided by the Commissioning Authority.
  - 5. Factory start-up services will be provided for key equipment and systems specified in Division 23. The Contractor shall coordinate this work with the manufacturer and the Commissioning Authority.
  - 6. Functional testing is intended to begin upon completion of a system. Commissioning may proceed prior to the completion of systems and/or sub-systems, if expediting this work is in the best interests of the



Owner. Commissioning activities and schedule will be coordinated with the Contractor. Start of commissioning before system completion will not relieve the Contractor from completing those systems as per the schedule.

- D. The Field Commissioning Notebook will be used to identify and track all pertinent commissioning documentation required during the Installation phase. This Notebook will be assembled by the Commissioning Authority and maintained by the Contractor. The Notebook provides a central location for the Commissioning Authority to identify, copy and organize all pertinent information and will include the following format:
1. Summary describing Notebook contents and use.
  2. Copy of Commissioning Plan for contractor field reference.
  3. Listing of all specification documentation requirements listed by specification section, with sign off spots for appropriate contractors.
  4. Tabs for each specification section with copies of pre-functional test check sheets provided by coordination of subcontractors and Commissioning Authority for contractor completion and space for related contractor-supplied documents.
  5. Prior to functional testing the Commissioning Authority will use this book to verify that all appropriate contractors have completed their work and signed off that they have done so. Once the Commissioning Authority is satisfied that all components of a system are complete functional testing will begin.

### **3.2 PARTICIPATION IN COMMISSIONING**

- A. Provide skilled technicians to start up and debug all systems within the division of work. These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program as it relates to each system and their technical specialty. Work schedules, time required for testing, etc., will be requested by the Commissioning Authority and coordinated by the Contractor. Contractor will ensure the qualified technician(s) are available and present during the agreed-upon schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.
- B. The Commissioning Authority reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or sub-system. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Commissioning Authority to get the job done. A liaison or intermediary between the Commissioning Authority and qualified factory representatives does not constitute the availability of a qualified technician for purposes of this work.

### **3.3 WORK TO RESOLVE DEFICIENCIES**

- A. Maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in a system that does not meet the original design intent. Correction of work will be completed under the direction of the Architect, with input from the Contractor, equipment supplier, and Commissioning Authority. Whereas all members will have input and the opportunity to discuss, debate, and work out problems, the Architect/Engineer of Record will have final jurisdiction on the necessary work to be done to achieve performance and or design intent.

### **3.4 ADDITIONAL COMMISSIONING**

- A. Additional commissioning activities may be required after system adjustments, replacements, etc., are completed. The Contractor, suppliers, and Commissioning Authority shall include a reasonable reserve to complete this work as part of their standard contractual obligations.

### **3.5 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS**

- A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and peak cooling seasons, as well as part-load conditions in the spring and fall. Initial commissioning will be done as soon as contract work is completed regardless of season. Subsequent commissioning may be undertaken at any time thereafter to ascertain adequate performance during the different seasons.
- B. All equipment and systems will be tested and commissioned in a peak season to observe full-load performance. Heating equipment will be tested during winter design extremes. Cooling equipment will be tested during summer design extremes, with a fully occupied building. The Contractor will be responsible to participate in the initial and the alternate peak season test of the systems required to demonstrate performance.
- C. Subsequent commissioning may be required under conditions of minimum and/or maximum occupancy or use. All equipment and systems affected by occupancy variations will be tested and commissioned at the minimum and peak loads to observe system performance. The Contractor will be responsible to participate in the occupancy sensitive testing of systems to provide verification of adequate performance.

### **3.6 TRAINING**

- A. The Contractor will be required to participate in the training of the Owner's engineering and maintenance staff for each mechanical system and the related components. Training may be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids, or in the field with the specific equipment. The type of training will be per the Owner's option.
- B. Training will be conducted jointly with the equipment vendors, the Contractor and Owner's operations and maintenance representatives. The Contractor will

be responsible for the generic training, as well as instructing the Owner's staff on the system peculiarities specific to this project.

### **3.7 SYSTEMS DOCUMENTATION**

- A. Contract Documents to incorporate field changes and revisions to system designs to account for actual constructed configurations will be addressed as required in Division 1. All drawings should be red-lined on two sets. Division 23 as-built drawings should include updated architectural floor plans, and the individual mechanical systems in relation to actual building layout.
  - 1. Maintain as-built red-lines on the job site as required in Division 1.
  - 2. In addition to the stated requirements for operation and maintenance data, provide one copy of equipment technical literature, operation and maintenance literature, and shop drawings to the Commissioning Authority as soon as they are available. This requirement is for review of these documents prior to distribution of multiple copies for the Owner's final use.

**END OF SECTION**

**SECTION 23 09 24**  
**DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. System description.
- B. Operator interface.
- C. System software.

**1.2 RELATED REQUIREMENTS**

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Division 26 - Equipment Wiring: Electrical characteristics and wiring connections.

**1.3 REFERENCE STANDARDS**

- A. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Addendum (2024).
- B. LonMark Interoperability Guide - LonMark Application-Layer Interoperability Guide and LonMark Layer 1-6 Interoperability Guide; Version 3.4; 2005.
- C. Modbus (PS) - The Modbus Organization Communications Protocol.; Latest Update.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL (DIR) - Online Certifications Directory; Current Edition.

**1.4 SUBMITTALS**

- A. See Section 01300 - Submittals, for submittal procedures.
- B. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.
- C. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
  - 1. Revise shop drawings to reflect actual installation and operating sequences.
- D. Operation and Maintenance Data:
  - 1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
  - 2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
  - 3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

- E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

## **1.5 QUALITY ASSURANCE**

- A. Perform work in accordance with NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.
- D. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

## **1.6 WARRANTY**

- A. See Division 1 for additional warranty requirements.
- B. Provide five year manufacturer's warranty for field programmable micro-processor based units.

# **PART 2 PRODUCTS**

## **2.1 MANUFACTURERS**

- A. Honeywell International, Inc: [www.honeywell.com/#sle](http://www.honeywell.com/#sle).

## **2.2 SCOPE**

- A. General: The direct digital control and energy management system (DDC/EMS) includes control panels, control devices, valves, actuators, all line and low voltage control and interlock wiring (including wiring to controllers, switches, timers, relays, etc.) and conduit and related equipment, as required for proper operation of all equipment. Provide all equipment, programming, labor, materials and services necessary for a complete, lawful and operating DDC/EMS as shown or noted on the drawings and as specified herein. All control wiring, line and low voltage shall be installed in conduit. Power wiring, power to DDC/EMS control panels and disconnect switches are included in the Electrical Specifications, except that power wiring for control devices such as controllers, valves, etc., is included in the control system. Electrical work shall be in accordance with Electrical Specifications. The system shall be direct digital control/electric. The control system shall be direct digital. Shall be Honeywell WEBS series Unitary devices. The system shall be Niagara 4, HTML5 based, with open license supervisory controller. The system shall communicate over the Campus Ethernet LAN/WAN and shall include the latest upgrading (software and firmware) during the warranty period. The data wiring shall have an Ethernet connection at the DDC/EMS panel. A Graphical User Interface (GUI) shall be provided. Coordinate with Section 23 00 01, Heating, Ventilating and Air Conditioning and with Division 26. Comply with ASHRAE 55 and Title 24.
- B. All work described in this section shall be installed, wired, circuited and calibrated by factory- certified technicians qualified for this work.

## **2.3 GENERAL**

- A. General Requirements: The Electronic Microprocessor Based Direct Digital Control and Energy Management System (DDC/EMS) shall monitor the data environment and perform control functions in relation to a programmed strategy and the status of the data environment. The system should use solid state computers based digital and analog technology. The system should be standard with the manufacturer to ensure on-going parts availability and technical support trained. The DDC/EMS shall be of the user programmable type requiring no special computer education for operation. All necessary instruction manuals and user orientation training shall be supplied by the manufacturer or agent thereof. The DDC/EMS shall be UL listed as a Direct Digital Control and Energy Management System. The programmable control requirements of the DDC/EMS shall include, but not be limited to:
1. OPTIMUM START/STOP (BASED ON HISTORICAL DATA) TIME OF DAY ROUTINES
  2. SCHEDULED OCCUPANCY ROUTINES INCLUDING HOLIDAYS  
CUSTOM TAILORED REPORTING ACCUMULATING RUN TIME
  3. CRITICAL CONDITION ALARMING
  4. FLUID FLOW SWITCH AND CONTROL ALARMING PID CONTROL ON ANALOG OUTPUTS
  5. HOT WATER RESET
  6. DAY/NIGHT SETBACK ECONOMIZER/PURGE CUSTOM TAILORED REPORTING
  7. POINT OVERRIDE ABILITY FOR EVERY DIGITAL AND ANALOG OUTPUT SEPARATE MODES AS REQUIRED BY CONTROL SEQUENCE ALL EXTERIOR LIGHTING CIRCUITS CONTROLLED BY SYSTEM
- B. Environment: The DDC/EMS shall operate in an environment of 40 120 degrees F and 10 95% relative humidity. Sensors and control elements shall operate under the temperature, pressure, humidity, and vibration conditions normally encountered in the installed location. The DDC/EMS shall maintain accuracy as follows:
1. +/- 0.5 F for the space temperatures in the 0 F 130 F range.
  2. +/- 0.5 F for duct temperatures in the 40 F 130 F range.
  3. +/- 1.0 F for outside air temperatures in the 30 230 F range.
  4. +/- 1.0 F for water temperature in the 30 230 F range.
  5. KWH and KW monitoring within 1.0%.

## **2.4 SYSTEM ARCHITECTURE**

- A. DDC/EMS Equipment: The main controller shall contain the network communications and information management programs providing integrated global control, trend logging, local and remote alarming and fully menu driven user interface. The local network controller must be an intelligent, stand-alone microprocessor-based controller which can have a variety of configurations based on their application.

- B. Campus-Wide Data Transfer System: The DDC/EMS shop drawings shall indicate where all equipment items are to be located for input and output to complete the system. The conduct/cabling system shall inter-tie these points as required to complete one system to meet the design criteria herein. Conduit shall be used for all EMS wiring whenever access is limited (hard-lid, walls, etc.). When EMS wiring is installed in/above accessible areas (such as T-bar ceilings), free-air with J-hooks and wire-ties is acceptable. However, EMS wiring cannot be intermixed or bundled with any other cable/wiring (Fire Alarm, internet, etc.). System high speed communication shall be hardwired using a Belden shielded cable as recommended by DDC manufacturer.
- C. User Interface Communication: The user may communicate with the DDC/EMS system with a workstation located at the District Office over the WAN, with a remote workstation, with an On-Campus Operator Workstation, or with a Lap-Top computer (Service Tool).
- D. Standard Network Support: All Master Controllers, Workstation(s) and File Server shall be capable of residing directly on the owner's Ethernet TCP/IP LAN/WAN. Furthermore, the Master Controllers, Workstation(s) and File Server shall be capable of using standard, commercially available, off-the-shelf Ethernet infrastructure components such as routers, switches and hubs. With this design the owner may utilize the investment of an existing or new enterprise network or structured cabling system. This also allows the option of the maintenance of the LAN/WAN to be performed by the owner's Information Technology Department as all devices utilize standard TCP/IP components. If the DDC/EMS contractor needs an additional data port that is not already provided, its installation must be coordinated with the District's IT department (and IT infrastructure contractor if applicable) and shall be installed at the DDC/EMS contractor's expense. As a result, the DDC/EMS contractor shall ensure any additional data port locations are clearly indicated and that the existing EMS data ports they intend to utilize are addressed/identified prior to construction, so they are not damaged or removed. This coordination shall occur between the Campus Construction Office, IT department, DDC/EMS operator, IT infrastructure contractor (if applicable), and the project's general construction contractor manager.

## **2.5 MICROSD BACKUP**

- A. The system should be tolerant of power failure and automatically save database on-board MicroSD chips. On power restoration, the system shall automatically and without operator intervention of execution of manual restart procedures:
  - 1. All Supervisory Controllers shall have a UPS Backup installed
  - 2. Update all monitored functions.
  - 3. Resume operation based on current time and status.
  - 4. Implement special building start up strategies as required.
  - 5. Log time of power outages and startups.

## **2.6 PROGRAM STORAGE**

- A. All FX-90 hardware licenses and certificates shall be stored on local MicroSD memory chip employing encrypted “safe boot” technology.

## **2.7 PROTOCOL**

- A. Protocol shall be BACnet. The Main Controller shall be enabled to support and shall be licensed with the following Open protocol drivers (client and server) by default
  1. BACnet
  2. Lon
  3. Modbus

## **2.8 MAIN CONTROLLER SHALL PROVIDE AS A MINIMUM**

- A. Two 10/100 Mbps Ethernet ports.
- B. Two Isolated RS-485 ports with biasing switches.
- C. 1 GB RAM
- D. 4 GB Flash Total Storage / 2 GB User Storage
- E. Wi-Fi (Client or WAP)
- F. USB Flash Drive
- G. High Speed Field Bus Expansion
- H. -20-60°C Ambient Operating Temperature
- I. Integrated 24 VAC/DC Global Power Supply
- J. MicroSD Memory Card Employing Encrypted Safe Boot Technology

## **2.9 JACE 9000 CONTROLLER**

- A. Shall be provided with a 5 Year (SMA) Software Maintenance Agreement. Labor to implement not included.
- B. The JACE-9000 shall be licensed for 100 devices minimum. If the number of controllers on the complete project exceeds 100, the JACE-9000 shall be licensed to support all of the devices plus an additional 10 for future expansion.

## **2.10 SYSTEMS DESCRIPTION**

- A. Modular Design/Expandability: The DDC/EMS shall be of a modular design providing distributed processing capability and allowing future expansion of both input/output points and processing/control functions. The modular DDC/EMS shall be configured on the main/local concept. The main controller shall have the capability of adding local controllers and the local controllers shall be capable of adding I/O modules.
- B. Main (Master) Description: The master shall function as the overall system coordinator, accept control programs, perform automated energy management functions, control peripheral devices and perform all necessary mathematical calculations. The master shall be a microcomputer of modular design. The word size shall be 16 bits or larger, with a memory cycle time less than 1



microsecond. All chips shall be second sourced. The master shall have the following:

1. Protected Access: Key lock protected access to output override switches and internal circuitry.
  2. Memory: The master shall have memory required for systems operation and diagnostics or MCP software.
  3. Real Time Clock: The master shall have a battery backed uninterruptable "Real Time Clock". The accuracy shall be within ten seconds per day. The RTC shall provide the following information: Time of Day, Day, Month, Year, and Day of Week. The system should be programmed to automatically correct the clock for daylight savings time and leap years and Time Sync.
  4. Power: The master shall operate from 120 VAC +/- 20%, 60 Hz. Line voltages below the operating range of the system shall be considered outages. The master shall have over voltage surge protection and require no additional AC power signal conditioning.
  5. Parallel Processing: The master shall be capable of parallel processing, executing separate control programs simultaneously. Any control program may affect control of another program if desired. Each program shall have full access to all I/O facilities of the processors.
  6. Communications Processor: Each master shall provide communication to the District's Workstation(s) (LAN) and the field buses. In addition, each master must have communications ports that support portable service tool and connection to third party controllers such as a chiller control panel or Variable Frequency Drives.
  7. Uninterruptable Functions: Control functions shall not be interrupted due to program entry or other user communications.
- C. Local Controller Units: The local units function as a stand-alone controller and as an Input/Output interface of the DDC/EMS and the Data Environment.
1. HVAC units must be fully controlled by a controller connected to the DDC/EMS that can be fully programmed by the DDC/EMS contractor.
  2. Monitoring: Local units shall be used to connect the data environment to the system and contain all necessary Input/Output functions to read field sensors and operate controlled equipment based on internal instructions or instructions from the Master. The units shall be fully supervised to detect failures. The units shall report the status of all points in their data environment at the rate of at least once every second. Local units shall connect directly to the Master with a twisted pair shielded RS-485 interface.
  3. Unit Failure: Upon failure of the unit (including transmission failure), the unit shall automatically fail off or to a predetermined state for three-way valves. All local units must run independently in the event of a central unit failure (including transmission failure) in bypass mode via the thermostat.
  4. Power: The unit shall operate from 120 VAC, +/-20%, 60 Hz, 220 VAC, +/- 20%, 50 Hz or 24 VAC +/- 20%, 50/60 Hz power. For voltages below

the operating threshold the unit shall totally shut down and de energize its outputs.

5. LAN and/or Field Bus: Each unit shall communicate with any unit through the RS-485 interface LAN and/or field bus.
6. Auxiliary Port: Each unit shall be equipped with an auxiliary port to allow local interrogation of input and output values, and keyboard override of outputs through laptop.

## **2.11 INPUT/OUTPUT CAPABILITY**

- A. Inputs: The DDC/EMS shall accept information in the form of a temperature, voltage, digital signal (on off) or pulse counter.
  1. Analog Inputs: The Analog Input (AI) function shall monitor each analog input, perform A/D conversion, and hold the digital value in a buffer for interrogation. The A/D conversion shall have a minimum resolution of 10 bits. Input ranges shall be within the range of 0-10 VDC.
  2. Pulse Accumulator Inputs: The pulse accumulator function shall have the same characteristics as the DI, except that, in addition, a buffer shall be included to totalize pulses between interrogations. Each input shall accept pulses at a minimum of 2 per second.
  3. Digital Inputs: The Digital Input (DI) function shall accept dry contact closures and voltage level or resistance level (5VDC reference voltage) transitions. A voltage level below 1 volt or a resistance below 500 ohms shall be read as ON (closed), a voltage level above 3 volts or a resistance above 1400 ohms shall be read as OFF (open).
  4. Temperature Inputs: Temperature inputs originating from a thermistor, shall be monitored and buffered as an AI, except that, automatic conversion to degrees F shall occur without any additional signal conditioning.
  5. Input Wiring: All analog inputs shall be two wire devices, with shielded wire for accurate operation.
- B. Outputs:
  1. Master and local controllers - Form C relay outputs rated at 5-amp, 24 VAC/DC or 2 amp, 30 VAC for on/off or Pulse Width Modulation for maintained operation of field devices. Output pulse width shall be selectable between 0.1 and 3200 seconds with a minimum resolution of 0.1 seconds. Isolation and protection against voltage surges shall be provided. Central plant controllers shall be equipped with an ON/OFF/AUTO switch to manually obtain either output state or able to be overridden from GUI. Manual overrides shall be reported to the master at each update. An LED shall be provided to indicate the state of each digital output.
  2. All digital and analog output points on every controller must have an override (highest priority) input point in the controller's point list in the FX80. This override point must be clearly labeled and identifiable. For example, "DO1ovrd" would be the point to override Digital Output 1.

## 2.12 SOFTWARE

- A. User Software: HTML5 based. Provide software (required upgrades) for Laptop Computer (Service Tool) and Facilities office workstation, as required.
- B. Software Features:
  - 1. Mathematical Requirements: The DDC/EMS shall have a math package capable of addition, subtraction, multiplication, division, square root, greater than and less than functions, minimum and maximum selection functions, and up to five levels of parenthesis for computation of variables. Control commands may be executed based on these calculated variables which are available to the program on a global basis. Math expressions may be used in action and exit commands of control programs. The mathematical software shall be capable of mixed mode arithmetic, utilizing Boolean logic statements in combination with basic arithmetic to provide conditional mathematical computations.
  - 2. Passwords: The DDC/EMS shall have multiple levels of user programmable passwords in addition to a master password, for programming security. Separate passwords may be user programmed. Level of password will define user's access level and ability to change system.
  - 3. Trend Logging: The DDC/EMS shall trend log variables. Any system variable (inputs, outputs, numerals, can be trend logged.
  - 4. Messages: The DDC/EMS shall provide alarming, preventative maintenance and status reporting messages. Documentation Format: The programming language of the DDC/EMS shall be plain English based such that a printout of the control program shall serve as the primary documentation for the system. Micro Processor Integrity Checking: Each DDC/EMS microprocessor shall continuously monitor and check itself and produce error messages in the event of a malfunction. Data Plotting: The DDC/EMS shall provide plots of values of system variables on a graph. Graphs may consist of combinations of up to 3 system variables at a time from the history logs. Color Graphics Requirements Provide Standard PX color graphics which allow user to access and change (based on user access level) all schedules and setpoints (including damper or control valve positions) directly through the user graphics. Real time data shall continuously be updated. Navigation between the screens (forward and backwards) shall be accomplished with the use of a mouse. The minimum graphic screens shall include the following: Site layout locations of all equipment being controlled, control component locations, and spaces served. Provide multiple screens-minimum of 1 screen per building plus site and others as needed for clarity. By "clicking" mouse on the desired equipment area a flow diagram will be displayed for the related equipment (as described below - Item 2). By "clicking" the mouse on a conditioned space, a graphic display of the zone conditions (as described below - Item 3) will be displayed. Each building must have a graphical summary

page of all the zones in that building that displays zone temperature, set point, discharge air temperature, and fan command. Zone & HVAC Equipment Description on GUI: Each item of HVAC equipment must be clearly identified by what area it serves and its unit number. For example, if HC-2A serves Classroom 4, the GUI should list it as "Classroom 4, HC-2A." It should NOT be listed as only "HC-2A" or "Classroom 4." Flow diagrams shall be provided for each HVAC system, such as air-handling system, chilled water system, hot water system, condenser water system, package unit system, brine system with all inputs and outputs dynamically displayed. Each temperature control zone shall have a screen providing set points, temperatures, and related HVAC system status data. Scheduling screens allowing On/Off times to be set.

5. Documentation Format: The programming language of the DDC/EMS shall be plain English based such that a printout of the control program shall serve as the primary documentation for the system.
  6. Micro Processor Integrity Checking: Each DDC/EMS microprocessor shall continuously monitor and check itself and produce error messages in the event of a malfunction.
  7. Data Plotting: The DDC/EMS shall provide plots of values of system variables on a graph. Graphs may consist of combinations of up to 3 system variables at a time from the history logs.
- C. Color Graphics Requirements Provide Standard PX color graphics which allow user to access and change (based on user access level) all schedules and setpoints (including damper or control valve positions) directly through the user graphics. Real time data shall continuously be updated. Navigation between the screens (forward and backwards) shall be accomplished with the use of a mouse. The minimum graphic screens shall include the following:
1. Site layout locations of all equipment being controlled, control component locations, and spaces served. Provide multiple screens-minimum of 1 screen per building plus site and others as needed for clarity. By "clicking" mouse on the desired equipment area a flow diagram will be displayed for the related equipment (as described below - Item 2). By "clicking" the mouse on a conditioned space, a graphic display of the zone conditions (as described below - Item 3) will be displayed.
  2. Each building must have a graphical summary page of all the zones in that building that displays zone temperature, set point, discharge air temperature, and fan command.
  3. Zone & HVAC Equipment Description on GUI: Each item of HVAC equipment must be clearly identified by what area it serves and its unit number. For example, if HC-2A serves Classroom 4, the GUI should list it as "Classroom 4, HC-2A." It should NOT be listed as only "HC-2A" or "Classroom 4."
  4. Flow diagrams shall be provided for each HVAC system, such as air-handling system, chilled water system, hot water system, condenser

- water system, package unit system, brine system with all inputs and outputs dynamically displayed.
5. Each temperature control zone shall have a screen providing set points, temperatures, and related HVAC system status data.
  6. Scheduling screens allowing On/Off times to be set.
- D. Software Manual: The software manual shall describe programming and testing, starting with a system overview and proceeding to a detailed description of each software feature. The manual shall instruct the user on programming or reprogramming any portion of the system. This shall include all control programs, variables, set points, time periods, messages, passwords and other necessary information to load, alter, test and execute the system. The manual shall include commands, editing and writing control programs, printouts and logs, mathematical calculations, and instructions on modifying any control point, verifying error status, changing passwords, and initiating or disabling control programs.
- E. Software Licenses: The owner shall be named the license holder of all software associated with all incremental work on the project(s). All Niagara 4 software licenses shall have the "accept.station.in=\*"; "accept.station.out=\*"; "accept.wb.in=\*"; and "accept.we.out=\*" section of the software licenses. The intent is to ensure that the installed Niagara 4 products may be completely open for integrations. Owner shall be free to direct the modification of the software license, regardless of supplier. In addition, the Owner shall receive ownership of all job- specific software configuration documentation, data files, and application-level software developed for this project. This shall include all custom job-specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use within Niagara Framework (Niagara 4) based controllers and/or servers and any related LAN/WAN/Intranet and Internet connected routers and devices. All required IDs and passwords for access to any component or software program shall be provided to the Owner.

## **2.13 USER INTERFACE**

- A. LAN Connections: If an additional LAN connection is needed, the conduit and cable from LAN rack is to be installed by electrical contractor. The planned location of all LAN connections (new and existing) to EMS equipment must be coordinated with the district's networking staff and EMS staff as early as possible. Final connections shall be made by DDC/EMS Contractor.
- B. Direct Computer Communication: The DDC/EMS shall have a computer compatible communication mode for communication with other intelligent devices, which performs data integrity checking, with automatic retransmission of data when errors are detected.
- C. JACE 9000 software must include all applications to make all folders viewable and accessible in the JACE 9000

## **2.14 SYSTEM COMPONENTS**

- A. Control Components:
1. Wall Switches: Plates for all wall switches and timers shall match those specified in Division 26.
  2. Labels: All labels, signs, etc. shall be engraved, laminated plastic, white on black background, 1/8" high lettering, minimum.
  3. Temperature Sensors:
    - a. Sensor Type: All temperature sensors shall be made of a highly stable, precision thermistor material accurate to within  $\pm 0.36$  Degrees F. Identify each temperature sensor with a "Limacoid" label keyed to the control system as-built drawings.
    - b. Room Sensor: Room temperature sensor shall have Executive Decorator housing with programmable visible temperature indication. Housing shall include an occupancy override, temperature setpoint adjustment and a service tool jack.
    - c. Vandal Resistant Room Sensor: Where noted, shall be a blank stainless steel wall plate with the sensing element bonded to the back side. The plate back shall be insulated to reduce wall temperature influence.
    - d. Duct Sensor: Duct temperature sensor shall be a probe type element with 9- inch insertion length. Elements shall be installed where air mixture provides a true temperature indication. Where adequate mixing is not practical, the duct temperature sensor shall have an averaging type of thermistor element, installed across the entire cross section of the duct.
    - e. Outdoor Air Sensor: Outdoor air temperature sensor shall be a probe type element mounted in a ventilated, treated white PVC sun shield to minimize radiant energy effects. The sensor and sun shield shall be mounted on a weatherproof outlet box for outdoor installation.
  4. Low Differential Air Pressure Applications (0" to 5" W.C.): The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points. Non- interactive zero and span adjustments, adjustable from the outside cover. (0.00 - 1.00" to 5.00") W.C. input differential pressure ranges. 4-20 mA output. Maintain accuracy up to 20 to 1 ratio turndown. Reference Accuracy:  $\pm 0.2\%$  of full span.
  5. CO2 Sensor: The sensor shall have a five-year recommended calibration interval. In addition, the sensor shall be provided with a five-year calibration guarantee, providing for free factory replacement if the sensor is found to be out of calibration within five years of the purchase date. The sensor should have accuracy of  $\pm 50$  ppm and repeatability of  $\pm 20$  ppm. All adjustments to the sensor including output scaling, elevation adjustment, relay set point, relay dead-band, linear or exponential output, and single point calibration shall be made via on-board push buttons and

LCD display. The LCD display must be covered by a solid door and only viewable when the door is open for adjustments.

- B. Temperature Control Panels: Each panel and each control device or readout on the front of the panel shall be identified with a laminated plastic label with 1/4" high engraved lettering, white on black background. Pilot lights shall be the push to test type.
- C. Smoke Detectors: Furnished by Division 23 and installed by Division 26. Power and fire alarm wiring by Division 28. Control wiring by Division 23. Coordinate with Division 26.
- D. Status Sensor: Current sensing status sensor (with sensitivity adjustment for belt loss detection).
- E. Electric Actuators:
  - 1. General: Fully modulating, UL listed. Visual position indicator, manual override and clear weather shield were exposed to weather. 24 volt. Belimo.
  - 2. Valve Actuators: Provide with factory mounting brackets and linkage to the control valve. Capable of shutting off against a 50-psi differential.
  - 3. Damper Actuators: Positive position feedback and spring return. OSA dampers shall be spring return closed. Actuators shall be direct mounted onto the damper control shaft without linkage. Damper actuators shall be sized to provide a minimum of 5 in-lbs torque per square foot of damper face area.
- F. VFD: Provide VFD drives for equipment as scheduled on drawings. Microprocessor-based, sensor less vector drives to provide adjustable speed control for three-phase motors. Include standard features that can be programmed to customize the drive's performance to suit a wide variety of applications, a digital display and operating and programming keys on a removable keypad and a SA Communication card as standard. JCI or equal.
- G. Lighting Contactors: Lighting contactors with metal enclosure will be furnished, installed, and wired to the lighting panel by the electrical contractor. See electrical contract documents for location. The DDC/EMS Contractor shall provide low voltage relay(s) required at the contactor panel and wire to the contactors to complete the DDC/EMS side of the lighting control. DDC/EMS Contractor shall provide required photocells. Relays shall be suitable for up to 277 volts.
- H. Lightning Arrestor and Surge Suppressors: Shall be provided as approved and/or manufactured by the DDC/EMS equipment manufacturer.
- I. Conduit: Conduit to be a minimum 3/4" diameter, and to have at least 25% spare capacity, except drops to room sensors may be run in 1/2" conduit. Conduit shall be run in electrical or mechanical trenches wherever possible. Site conduit (building to building) will be installed (and terminated inside the building) by Division 26.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify existing conditions before starting work.

### **3.2 INSTALLATION**

- A. General: All electrical work shall be in accordance with the California Electrical Code and the Electrical Specification Sections. All electric/electronic systems shall be hardwired in conduit, except as specifically allowed by 1.3, B. Wiring shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed wiring shall run parallel to room surfaces; location shall be approved by the Architect. No structural member shall be weakened by cutting, notching, boring or otherwise. Provided by Section 26000 a 120-volt circuit for each device requiring external power. Dedicated circuits shall be provided where required. Any devices or wiring exposed to the weather shall be protected in weatherproof enclosures such as NEMA 3R and weatherproof conduit.
- B. Programming:
  - 1. The Direct Digital Control and Energy Management System (DDC/EMS) operational program shall be provided by the DDC/EMS Contractor. The DDC/EMS Contractor shall be responsible for programming the system and shall coordinate the scheduling (on/off times) with the Owner. Prior to start-up, the DDC/EMS Contractor shall provide any testing program he feels necessary to fully test the operation of the various components.
  - 2. The DDC/EMS Contractor shall load the operational program into the DDC/EMS controller from his office via the district's network (via VPN) or at the job site via a direct connect cable. Prior to starting up the system, the DDC/EMS Contractor shall:
    - a. Confirm that the control system has been connected to the Campus LAN/WAN and that the LAN/Wan is working.
    - b. Confirm the functionality of the DDC/EMS controllers and all input points by reading the input values, and comparing them with a measured temperature, pressure, voltage, current, or resistance as appropriate. Calibrate all transducers as required.
    - c. Confirm the functionality of all digital output points by manual operational of the relay contacts. Use proper discretion in starting and stopping equipment.
    - d. Confirm the functionality of all analog output points by manually imposing an adjustable voltage on the appropriate circuit to check proper operation of the controlled device. Calibrate all transducers as required.
    - e. The DDC/EMS Contractor shall notify the General Contractor (one week in advance) when the system will be ready for loading and testing the operational program. The DDC/EMS Contractor's start-up technician shall be present while the program is being loaded



- and shall communicate with the programmer prior and after program loading to confirm proper operation.
3. Training: Prior to final acceptance, the DDC/EMS Contractor shall provide operational training to the Owner's personnel. The training sessions shall include a complete demonstration of the system. Dates and times of the training sessions shall be coordinated through the Owner not less than one week prior to session. A total of 40 hours of instruction shall be provided. The DDC/EMS Contractor shall maintain a log of training sessions including dates, times and names/titles of those attending. The DDC/EMS Contractor shall submit a copy of this log on request. Contractor shall provide 1 week factory certified training schedule and class at owners' discretion.
  4. Testing and Acceptance: The DDC/EMS Contractor shall furnish a complete operating system. The DDC/EMS Contractor shall also verify, in the presence of the Owner, the system accuracy and proper function of each controlled device and sensor. The following items shall be successfully demonstrated prior to acceptance by the Owner:
    - a. All system outputs including controllers, relays, and other control devices shall be addressed and start/stop functions demonstrated.
    - b. All inputs shall be displayed, and all event-initiated functions shall be demonstrated.
    - c. Demonstrate program integrity and power restore sequence during and after a power failure and restoration.
    - d. Deliver all Record Drawings, wiring diagrams, equipment specifications, installation and Operation Manuals and other documentation as required to describe the system.
    - e. Complete operator training in the use, programming, and operation of the system.
  5. Start-up of the System:
    - a. The start-up period starts when the following conditions are met:
      - 1) The DDC/EMS system and all involved HVAC equipment have been installed, connected to the DDC/EMS system and are ready to operate.
      - 2) A start-up meeting has been conducted with representatives of the General Contractor, Architect/Engineer, Maintenance Staff, and the DDC/EMS Contractor.
      - 3) Consensus is reached by the representatives at the above-mentioned meeting that it is appropriate for the start-up process to start.
    - b. The alarm pagers called by the control system during the start-up period shall be the pagers carried by the Mechanical Contractor and/or DDC/EMS Contractor as appropriate. The Mechanical Contractor and DDC/EMS Contractor shall respond to all pages from the control system and work cooperatively to ensure that the building environmental standards are maintained.

- c. The start-up process shall be completed, and the warranty period shall start when the following conditions are met.
    - 1) All training to be provided as part of the project has been completed.
  - d. No "alarm" or "condition reports" are being generated by the DDC/EMS system for seven (7) calendar days (168 hours) due to incomplete or inaccurate installation or programming.
  - e. All adjustments and "fine tuning" of the system have been completed.
6. Verification:
- a. A written testing and start-up report must be submitted for approval before acceptance. In addition to the DDC/EMS Contractor's testing and start-up report, the Owner may independently verify the test results. The report on test results should include setpoints and operating ranges of all components.

**SECTION 23 23 00  
REFRIGERANT PIPING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Piping.
- B. Valves.
- C. Flexible connections.

**1.2 RELATED REQUIREMENTS**

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 23 07 19 - HVAC Piping Insulation.

**1.3 REFERENCE STANDARDS**

- A. AHRI 495 - Performance Rating of Refrigerant Liquid Receivers; 2005.
- B. AHRI 710 (I-P) - Performance Rating of Liquid-Line Driers; 2009.
- C. AHRI 730 (I-P) - Flow Capacity Rating of Suction Line Filters and Suction Line Filter Driers; 2013 (Reapproved 2014).
- D. AHRI 760 (I-P) - Performance Rating of Solenoid Valves for Use with Volatile Refrigerants; 2014.
- E. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2022, with Addendum (2024).
- F. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; 2022, with Errata (2024).
- G. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023, with Errata (2024).
- H. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
- I. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2022.
- J. ASME B31.9 - Building Services Piping; 2020.
- K. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
- L. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.
- M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- N. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

- O. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.
- P. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).
- Q. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.
- R. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
- S. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

#### **1.4 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide general assembly of specialties, including manufacturer's catalogue information. Provide manufacturer's catalog data including load capacity.
- C. Design Data: Submit design data indicating pipe sizing. Indicate load-carrying capacity of trapeze, multiple pipe, and riser support hangers.
- D. Test Reports: Indicate results of leak test, acid test.
- E. Project Record Documents: Record exact locations of equipment and refrigeration accessories on record drawings.

#### **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store piping and specialties in shipping containers with labeling in place.
- B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
- C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

### **PART 2 PRODUCTS**

#### **2.1 SYSTEM DESCRIPTION**

- A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure integrity of system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

- B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.
- C. Valves:
  - 1. Use service valves on suction and discharge of compressors.
- D. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

## **2.2 REGULATORY REQUIREMENTS**

- A. Comply with ASME B31.9 for installation of piping system.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.
- C. Welders Certification: In accordance with ASME BPVC-IX.
- D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

## **2.3 PIPING**

- A. Copper Tube: ASTM B 280, H58 hard drawn, sealed ends.
  - 1. Fittings: ASME B16.22 wrought copper.
  - 2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
- B. Pipe Supports and Anchors:
  - 1. Conform to ASME B31.5.
  - 2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron adjustable swivel, split ring.
  - 3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
  - 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
  - 5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
  - 6. Vertical Support: Steel riser clamp.
  - 7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  - 8. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
  - 9. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
  - 10. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

## **2.4 VALVES**

- A. Manufacturers:
  - 1. Hansen Technologies Corporation: [www.hantech.com/#sle](http://www.hantech.com/#sle).
  - 2. Henry Technologies: [www.henrytech.com/#sle](http://www.henrytech.com/#sle).
  - 3. Flomatic Valves: [www.flomatic.com/#sle](http://www.flomatic.com/#sle).

- B. Service Valves:
  - 1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or soldered ends, for maximum pressure of 500 psi.

## **2.5 FLEXIBLE CONNECTORS**

- A. Manufacturers:
  - 1. Circuit Hydraulics, Ltd: [www.circuit-hydraulics.co.uk/#sle](http://www.circuit-hydraulics.co.uk/#sle).
  - 2. Flexicraft Industries: [www.flexicraft.com/#sle](http://www.flexicraft.com/#sle).
  - 3. Penflex: [www.penflex.com/#sle](http://www.penflex.com/#sle).
- B. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 500 psi.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Ream pipe and tube ends. Remove burrs. Bevel plain-end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

### **3.2 INSTALLATION**

- A. Install refrigeration specialties in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and avoid interference with use of space.
- D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Pipe Hangers and Supports:
  - 1. Install in accordance with ASME B31.5.
  - 2. Steel hanger rods and clevis shall be cadmium or zinc plated.
  - 3. Support horizontal piping as indicated.
  - 4. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 5. Place hangers within 12 inches of each horizontal elbow.
  - 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  - 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  - 8. Provide copper plated hangers and supports for copper piping.

- G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
- H. Provide clearance for installation of insulation and access to valves and fittings.
- I. Provide access to concealed valves and fittings.
- J. Flood piping system with nitrogen when brazing.
- K. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.
- L. Insulate piping.
- M. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.
- N. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.
- O. Fully charge completed system with refrigerant after testing.

### **3.3 FIELD QUALITY CONTROL**

- A. Test refrigeration system in accordance with ASME B31.5.

### **3.4 SCHEDULES**

- A. Hanger Spacing for Copper Tubing.
  - 1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
  - 2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  - 3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
  - 4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 5. 2-1/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 6. 2-5/8 inch OD: Maximum span, 9 feet; minimum rod size, 3/8 inch.

**END OF SECTION**

**SECTION 23 31 00  
HVAC DUCTS AND CASINGS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Metal ducts.
- B. Flexible ducts.
- C. Air plenums and casings.

**1.2 RELATED REQUIREMENTS**

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 230713 - Duct Insulation.
- C. Section 23 33 00 - Air Duct Accessories.

**1.3 REFERENCE STANDARDS**

- A. ASHRAE Std 126 - Method of Testing HVAC Air Ducts; 2020.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- E. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.
- F. ASTM E2336 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems; 2020.
- G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
- H. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.
- I. NFPA 91 - Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids; 2020.
- J. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.
- K. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
- L. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.



- M. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.
- N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.
- O. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.
- P. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies; Current Edition, Including All Revisions.

#### **1.4 RELATED SECTIONS**

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 23.

#### **1.5 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide data for duct materials.
- C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for all ductwork systems. Provide 1/4"=1'-0" ductwork layout plans showing duct routing, offsets, fittings, duct accessories, fire/smoke dampers, hydronic piping, seismic bracing, etc. Shop drawings shall be fully coordinated with all other trades, including the building structure, finishes, fire sprinkler piping, plumbing piping, hydronic piping and electrical systems.
- D. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

#### **1.6 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.
- B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

#### **1.7 FIELD CONDITIONS**

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

### **PART 2 PRODUCTS**

## **2.1 GENERAL REQUIREMENTS**

- A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A, NFPA 90B, and SMACNA (DCS) guidelines unless stated otherwise.
- B. Ductwork to be galvanized steel unless otherwise indicated.
- C. Duct Sealing and Leakage in accordance with Static Pressure Class:
  - 1. Duct Pressure Class and Material for Common Mechanical Ventilation Applications:
    - a. Supply Air: 2 in-wc pressure class, galvanized steel.
    - b. Outside Air Intake: 1/2 in-wc pressure class, galvanized steel.
    - c. Return and Relief Air: 1 in-wc 2 in-wc pressure class, galvanized steel.
    - d. General Exhaust Air: 1/2 in-wc pressure class, galvanized steel.
  - 2. Low Pressure Service: Up to 2 in-wc:
    - a. Seal: Class C, apply to seal off transverse joints.
  - 3. Low Pressure Service: From 2 in-wc to 3 in-wc:
    - a. Seal: Class B, apply sealing of transverse joints and longitudinal seams.
  - 4. Medium and High Pressure Service: Above 3 in-wc:
    - a. Seal: Class A, apply sealing of transverse joints, longitudinal seams, and duct wall penetrations.
- D. Duct Fabrication Requirements:
  - 1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
  - 2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
  - 3. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
  - 4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
  - 5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
  - 6. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.
  - 7. Exposed ductwork within occupied spaces shall be 20 gauge minimum.

## **2.2 METAL DUCTS**

- A. Material Requirements:

1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.
- B. Round Spiral Duct:
  1. Round spiral lock seam duct with galvanized steel outer wall.
  2. Manufacturers:
    - a. EHG, a DMI Company: [www.ehgduct.com/#sle](http://www.ehgduct.com/#sle).
    - b. Elgen Manufacturing Company, Inc: [www.elgenmfg.com/#sle](http://www.elgenmfg.com/#sle).
    - c. Linx Industries, Inc, a DMI Company: [www.li-hvac.com/#sle](http://www.li-hvac.com/#sle).
    - d. MKT Metal Manufacturing: [www.mktduct.com/#sle](http://www.mktduct.com/#sle).
- C. Connectors, Fittings, Sealants, and Miscellaneous:
  1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
  2. Transverse Duct Connection System: SMACNA "E" rated rigid class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).
    - a. Manufacturers:
      - 1) Carlisle HVAC Products: [www.carlislehvac.com/#sle](http://www.carlislehvac.com/#sle).
      - 2) Ductmate Industries, Inc, a DMI Company  
: [www.ductmate.com/#sle](http://www.ductmate.com/#sle).
      - 3) Elgen Manufacturing Company, Inc  
: [www.elgenmfg.com/#sle](http://www.elgenmfg.com/#sle).
  3. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
    - a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
    - b. VOC Content: Not more than 250 g/L, excluding water.
    - c. Sealants intended for use outdoors to include UV inhibitors.
    - d. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
    - e. Manufacturers:
      - 1) Carlisle HVAC Products; Hardcast Duct-Seal 321 Indoor/Outdoor Water Based Duct Sealant  
: [www.carlislehvac.com/#sle](http://www.carlislehvac.com/#sle).
      - 2) Design Polymerics; DP 1010 Water Based Smooth Duct Sealant, Premium Quality: [www.designpoly.com/#sle](http://www.designpoly.com/#sle).
      - 3) Ductmate Industries, Inc, a DMI Company  
: [www.ductmate.com/#sle](http://www.ductmate.com/#sle).
  4. Gasket Tape:
    - a. Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle ring connections.
    - b. Manufacturers:

- 1) Design Polymerics; DP 1040 100 Percent Solids, High Pressure/High-Velocity Butyl Gasket  
Tape: [www.designpoly.com/#sle](http://www.designpoly.com/#sle).
- 2) Elgen Manufacturing Company, Inc; 440 Butyl Gasket  
Tape: [www.elgenmfg.com/#sle](http://www.elgenmfg.com/#sle).

## **2.3 FLEXIBLE DUCTS**

- A. Flexible Air Ducts:
  1. UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound spring steel wire.
  2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
  3. Pressure Rating: From 4 in-wc positive to 0.5 in-wc negative.
  4. Maximum Velocity: 4,000 fpm.
  5. Temperature Range: Minus 20 to 210 degrees F.
  6. Manufacturers:
    - a. JP Lamborn Co: [www.jpflex.com/#sle](http://www.jpflex.com/#sle).
    - b. Atco Rubber Products, Inc..

## **2.4 AIR PLENUMS AND CASINGS**

- A. Fabricate in accordance with SMACNA (DCS) for indicated operating pressures indicated.
- B. Minimum Fabrication Requirements:
  1. Fabricate acoustic plenum or casing with reinforcing turned inward.
  2. Provide 16-gauge, 0.059-inch sheet steel back facing and 22-gauge, 0.029-inch perforated sheet steel front facing with 3/32 inch diameter holes on 5/32 inch centers.
  3. Construct panels 1 inches thick, packed with 4.5 pcf minimum glass fiber insulation media, on inverted channel of 16-gauge, 0.059-inch sheet steel.
- C. Access Doors:
  1. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.
  2. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install products following the manufacturer's instructions.
- C. Comply with safety standards NFPA 90A and NFPA 90B.
- D. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

- E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- F. Ductwork exposed to view outdoors shall be primed and painted, color by architect.
- G. Flexible Ducts: Connect to metal ducts with adhesive plus sheet metal screws.
- H. Flexible Ducts: Maximum length of single runout to air inlet or outlet to be 5 feet per CMC.
- I. Duct sizes indicated are outside dimensions. For lined ducts, duct sizes must be increased to account for lining.
- J. Seal all standing seams and transverse joints in all sheetmetal ductwork with Hardcast DT tape, 4 inches wide, and Hardcast FTA-20 adhesive.
- K. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- L. Use double nuts and lock washers on threaded rod supports.
- M. Connect diffusers boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

**END OF SECTION**

**SECTION 23 33 00**  
**AIR DUCT ACCESSORIES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Air turning devices.
- B. Backdraft dampers - metal.
- C. Duct access doors.
- D. Duct test holes.
- E. Flexible duct connectors.
- F. Volume control dampers.
- G. Miscellaneous Products:
  - 1. Damper operators.

**1.2 RELATED REQUIREMENTS**

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 23 31 00 - HVAC Ducts and Casings.

**1.3 REFERENCE STANDARDS**

- A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
- D. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.
- E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
- F. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.
- G. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.

**1.4 RELATED SECTIONS**

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 23.

## **1.5 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.

## **1.6 PROJECT RECORD DOCUMENTS**

- A. Record actual locations of access doors and test holes.

## **1.7 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Protect dampers from damage to operating linkages and blades.

# **PART 2 PRODUCTS**

## **2.1 AIR TURNING DEVICES**

- A. Manufacturers:
  - 1. ProRail, Ductmate Industries, Inc.
  - 2. Duro Dyne Corp.
- B. Manufactured turning vanes with 2" single thickness curved blades set at 1-1/2" on-center mounted in 2" vane rails, self-aligning, hot dipped galvanized steel.
- C. Turning vanes, vane rails and mounting shall be constructed and installed in accordance with the SMACNA "HVAC Duct Construction Standards".

## **2.2 BACKDRAFT DAMPERS - METAL**

- A. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.
- B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

## **2.3 DUCT ACCESS DOORS**

- A. Manufacturers:
  - 1. Ductmate Industries, Inc, a DMI Company: [www.ductmate.com/#sle](http://www.ductmate.com/#sle).
  - 2. Ruskin Company: [www.ruskin.com/#sle](http://www.ruskin.com/#sle).
  - 3. or equal.

- B. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick-fastening locking devices. For insulated ducts, install minimum 1-inch thick insulation with sheet metal cover.
  - 1. High Temperature Duct Access Doors:
    - a. Comply with NFPA 96.
    - b. Comply with UL 1978.
- C. Access doors with sheet metal screw fasteners are not acceptable.

## **2.4 DUCT TEST HOLES**

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

## **2.5 FLEXIBLE DUCT CONNECTORS**

- A. Manufacturers:
  - 1. Carlisle HVAC Products: [www.carlislehvac.com/#sle](http://www.carlislehvac.com/#sle).
  - 2. Ductmate Industries, Inc, a DMI Company: [www.ductmate.com/#sle](http://www.ductmate.com/#sle).
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Flexible Duct Connections (Indoors): Fabric crimped into metal edging strip.
  - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq yd.
    - a. Net Fabric Width: Approximately 2 inches wide.
  - 2. Metal: 3 inches wide, 24 gauge, 0.0239 inch thick galvanized steel.
- D. Flexible Duct Connections (Outdoors): Fabric crimped into metal edging strip.
  - 1. Fabric: Ventfabrics Ventlon UL listed fire-retardant duPont's Hypalon coated woven glass fiber fabric to NFPA 90A, minimum density 26 oz per sq yd, sunlight, ozone and weather resistant.
    - a. Net Fabric Width: Approximately 3 inches wide.
  - 2. Metal: 3 inches wide, 24 gage thick galvanized steel.

## **2.6 VOLUME CONTROL DAMPERS**

- A. Manufacturers:
  - 1. Nailor Industries, Inc: [www.nailor.com/#sle](http://www.nailor.com/#sle).
  - 2. Ruskin Company: [www.ruskin.com/#sle](http://www.ruskin.com/#sle).
  - 3. United Enertech: [www.unitedenertech.com/#sle](http://www.unitedenertech.com/#sle).
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Single Blade Dampers for Round Ductwork and Rectangular Ductwork up to 10 inches in Height: 18 gauge steel minimum.
- D. Multi-Blade Damper for Rectangular Ductwork: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware; Model CD35 Manufactured by Ruskin. Provide Ruskin Model CD50 for installation in medium pressure ductwork and/or ducts with velocities exceeding 1500 FPM.



- E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings, Ventlok Model 607. On multiple blade dampers, provide oil impregnated nylon or sintered bronze bearings.
- F. Quadrants:
  - 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
  - 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
  - 3. Where rod lengths exceed 30 inches provide regulator at both ends.

## **2.7 MISCELLANEOUS PRODUCTS**

- A. Remote Balancing Damper Operator: Cable operated remote damper controller.
  - 1. Manufacturers:
    - a. Young Regulator Co.; [www.youngregulator.com](http://www.youngregulator.com)
  - 2. "Bowden" damper regulator with mounting bracket, hub and cable coupling.
  - 3. "Bowden" stainless steel operating cable and control wrench. Cable to be 50 foot length standard.
  - 4. Recessed control box with control shaft, cable coupling and cover plate.
  - 5. Provide options and accessories as needed for balancing damper.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Verify that electric power is available and of the correct characteristics.

### **3.2 INSTALLATION**

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 23 31 00 for duct construction and pressure class.
- B. Coordinate fire/smoke damper requirements with Division 26 and Division 28.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96 Provide minimum 14 by 14 inch size access door for hand and shoulder access, or as indicated on drawings.
- D. For concealed balancing dampers only where damper is inaccessible, provide Young Regulator "Bowden" cable operated damper controller.
- E. Provide duct test holes where indicated and required for testing and balancing purposes.
- F. Provide balancing dampers at points on supply, return, outside air and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

- G. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

**END OF SECTION**

**SECTION 23 34 23**  
**HVAC POWER VENTILATORS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Roof exhausters.

**1.2 RELATED REQUIREMENTS**

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.
- B. Section 23 31 00 - HVAC Ducts and Casings.

**1.3 REFERENCE STANDARDS**

- A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.
- B. AMCA 99 - Standards Handbook; 2016.
- C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2020.
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).
- E. AMCA 211 - Certified Ratings Program Product Rating Manual for Fan Air Performance; 2022, with Editorial Revision (2023).
- F. AMCA 260 - Laboratory Methods of Testing Induced Flow Fans for Rating; 2020.
- G. AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.
- H. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.
- I. AMCA 311 - Certified Ratings Program Product Rating Manual for Fan Sound Performance; 2016.
- J. ANSI Z9.5 - Laboratory Ventilation; 2022.
- K. NFPA 91 - Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids; 2020.
- L. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.
- M. UL 705 - Power Ventilators; Current Edition, Including All Revisions.
- N. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

**1.4 RELATED SECTIONS**

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.

- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 23.

### **1.5 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide data on fans and accessories, including fan curves with specified operating point plotted, power, rpm, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- C. Manufacturer's Instructions: Indicate installation instructions.
- D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

### **1.6 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

### **1.7 DELIVERY, STORAGE, AND PROTECTION**

- A. Protect units from physical damage by storing indoors or off site until roof mounting curbs or other mountings are in place, ready for immediate installation of units.

### **1.8 WARRANTY**

- A. See Division 1 for additional warranty requirements.
- B. Provide a full parts warranty for one year from start-up or 18 months from shipment, whichever occurs first.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Greenheck Fan Corporation: [www.greenheck.com/#sle](http://www.greenheck.com/#sle).
- B. Loren Cook Company: [www.lorencook.com/#sle](http://www.lorencook.com/#sle).

### **2.2 POWER VENTILATORS - GENERAL**

- A. Static and Dynamically Balanced: Comply with AMCA 204.
- B. Performance Ratings: Comply with AMCA 210, bearing certified rating seal.
- C. Sound Ratings: Comply with AMCA 301, tested to AMCA 300, bearing certified sound ratings seal.
- D. Fabrication: Comply with AMCA 99.
- E. UL Compliance: UL 705, listed, labeled, designed, manufactured, and tested.

- F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- G. Kitchen Hood Exhaust Fans: Comply with requirements of NFPA 96 and UL 762.

## **2.3 ROOF EXHAUSTERS**

- A. Product Requirements:
  - 1. Performance Ratings: Conform to AMCA 210 and bearing the AMCA Certified Rating Seal.
  - 2. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing AMCA Certified Sound Rating Seal.
  - 3. Fabrication: Conform to AMCA 99.
  - 4. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- B. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.
- C. Roof exhaust fans fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure. The fan shroud shall have a rolled bead for added strength.
- D. Motors shall be heavy duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Motors and drives shall be mounted on vibration isolators, out of the airstream. Fresh air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants. Motors shall be readily accessible for maintenance.
- E. A disconnect switch shall be factory installed and wired from the fan motor to a junction box installed within the motor compartment.
- F. A fan conduit chase shall be provided through the curb cap to the motor compartment for ease of installation.
- G. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.
- H. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.
- I. Roof Curb: 12 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, and insulation.
- J. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.
- K. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm

gets attained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

- L. See drawing schedule for additional optional equipment requirements.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with stainless steel lag screws to roof curb. See drawings for additional mounting requirements.
- C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.
- D. Provide sheaves required for final air balance.
- E. Provide speed control on direct drive fans required for final air balance.
- F. Install backdraft dampers on inlet to roof exhausters.
- G. Provide backdraft dampers on outlet from cabinet and ceiling exhaust fans and as indicated.

**END OF SECTION**

**SECTION 23 37 00  
AIR OUTLETS AND INLETS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Diffusers
- B. Registers/grilles
- C. Gravity ventilators.

**1.2 RELATED REQUIREMENTS**

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

**1.3 REFERENCE STANDARDS**

- A. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017 (Reaffirmed 2023).
- B. ADC 1062: GRD - Test Code for Grilles, Registers & Diffusers; Air Diffusion Council; 1984.
- C. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.
- D. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2021, with Editorial Revision (2022).
- E. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers; 2022.
- F. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.
- G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- J. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
- K. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.
- L. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.
- M. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

**1.4 RELATED SECTIONS**

- A. The Drawings and General Provisions of the Contract, including the General Conditions, Special Conditions and Division 1 General Requirements apply to this section.
- B. The Contract Agreement, Bidding Documents and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the mechanical systems.
- C. The requirements of this Section apply to all Work of Division 23.

## **1.5 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
- C. Project Record Documents: Record actual locations of air outlets and inlets.

## **1.6 QUALITY ASSURANCE**

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. Test and rate louver performance in accordance with AMCA 500-L.
- C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Krueger-HVAC: [www.krueger-hvac.com/#sle](http://www.krueger-hvac.com/#sle).
- B. Price Industries: [www.price-hvac.com/#sle](http://www.price-hvac.com/#sle).
- C. Ruskin Company: [www.ruskin.com/#sle](http://www.ruskin.com/#sle).
- D. Titus, a brand of Air Distribution Technologies: [www.titus-hvac.com/#sle](http://www.titus-hvac.com/#sle).
- E. Tuttle and Bailey: [www.tuttleandbailey.com/#sle](http://www.tuttleandbailey.com/#sle).

### **2.2 DIFFUSERS**

- A. Frame: Provide surface mount, snap-in, inverted T-bar, and spline type. In plaster ceilings, provide plaster frame and ceiling frame.
- B. Fabrication: Steel or aluminum with baked enamel finish.
- C. Color by Architect.
- D. Accessories: Provide radial opposed blade, butterfly, combination splitter, and volume control damper; removable core, sectorizing baffle, safety chain, wire guard, equalizing grid, operating rod extension, and gaskets for surface mounted diffusers with damper adjustable from diffuser face.
- E. SEE DRAWINGS FOR DIFFUSER SPECIFICATIONS.



### **2.3 REGISTERS/GRILLES**

- A. Frame: Provide surface mount, snap-in, inverted T-bar, and spline type. In plaster ceilings, provide plaster frame and ceiling frame.
- B. Fabrication: Steel or aluminum with baked enamel finish.
- C. Color by Architect.
- D. Accessories: Provide radial opposed blade, butterfly, combination splitter, and volume control damper; removable core, sectorizing baffle, safety chain, wire guard, equalizing grid, operating rod extension, and gaskets for surface mounted diffusers with damper adjustable from diffuser face.
- E. SEE DRAWINGS FOR REGISTER/GRILLE SPECIFICATIONS.

### **2.4 GRAVITY VENTILATORS**

- A. Hood Intake and Relief Gravity Ventilator:
  - 1. Manufacturers:
    - a. Greenheck Fan Corporation: [www.greenheck.com/#sle](http://www.greenheck.com/#sle).
    - b. Loren Cook Company: [www.lorencook.com/#sle](http://www.lorencook.com/#sle).
  - 2. General:
    - a. Low silhouette for intake and relief applications with natural gravity or negative pressure system(s).
    - b. Performance ratings and factory testing in accordance with AMCA 511 and AMCA 550.
    - c. Suitable for non-ducted applications.
    - d. Equipment to bear permanently affixed manufacturer's nameplate listing model and serial number.
  - 3. Hood and Base:
    - a. Material: Aluminum.
    - b. Hood Construction: Precision formed, arched panels with interlocking seams.
    - c. Vertical End Panels: Fully locked into hood end panels.
  - 4. Birdscreen:
    - a. Fabricate in accordance with ASTM B221 (ASTM B221M).
    - b. Construction: 1/2 inch Galvanized mesh.
    - c. Horizontally mounted across hood intake area.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.
- C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

- D. Install diffusers to ductwork with air tight connection.
- E. Provide balancing dampers on duct take-off to diffusers and grilles and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.
- F. Paint ductwork visible behind air outlets and inlets matte black.

**END OF SECTION**

**SECTION 23 74 13**  
**PACKAGED OUTDOOR CENTRAL-STATION AIR-HANDLING UNITS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Packaged Heat Pump Unit.

**1.2 RELATED REQUIREMENTS**

- A. Refer to the General Conditions, Special Conditions and Division 1 General Requirements. The requirements of these sections apply to this section.

**1.3 REFERENCE STANDARDS**

- A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.
- B. AHRI 270 (SI/I-P) - Sound Performance Rating of Outdoor Unitary Equipment; 2025.
- C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
- D. Unit shall be designed to conform to ASHRAE 15, latest revision, and in accordance with UL 1995.
- E. Units shall be UL tested and certified in accordance with ANSI Z21.47 Standard. Units may be ETL listed.
- F. New roof curbs shall be designed to conform to NRCA Standards.
- G. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

**1.4 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.
- C. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

**1.5 QUALITY ASSURANCE**

Packaged Outdoor Central-Station Air-  
Handling Units  
23 74 13 - 1

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

#### **1.7 WARRANTY**

- A. See Division 1 for additional warranty requirements.
- B. Provide a five year warranty to include coverage for refrigeration compressors.
- C. Provide a full parts warranty for one year from start-up or 18 months from shipment, whichever occurs first.
- D. Furnish one complete set of fan motor drive belts.

### **PART 2 PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Packaged Air Conditioning Units
  - 1. The Carrier Corporation.
  - 2. The Trane Company.
  - 3. or equal.

#### **2.2 PACKAGED HEAT PUMP UNITS**

- A. General
  - 1. Outdoor, rooftop mounted, electrically controlled, heating and cooling unit utilizing hermetic scroll compressor(s) for cooling duty and heat pump for heating duty.
  - 2. Factory assembled, single piece heating and cooling rooftop unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field start-up.
  - 3. Unit shall use R-454b refrigerant.
  - 4. Unit shall be installed in accordance with the manufacturer's instructions.
  - 5. Unit must be selected and installed in compliance with local, state, and federal codes.
  - 6. Unit shall meet ASHRAE 90.1 and IECC minimum efficiency requirements.
  - 7. Unit shall be rated in accordance with AHRI Standards 210/240 and 340/360.
  - 8. Unit shall be designed to conform to ASHRAE 15.

Packaged Outdoor Central-Station Air-  
Handling Units  
23 74 13 - 2

9. Unit shall be UL-tested and certified in accordance with ANSI Z21.47 Standards and UL or ETL-listed and certified under Canadian standards as a total package for safety requirements.
  10. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
  11. Unit internal insulation linings shall be resistant to mold growth in accordance with "mold growth and humidity" test in ASTM C1338, G21, and UL 181 or comparable test method. Air stream surfaces shall be evaluated in accordance with the "Erosion Test" in UL 181, as part of ASTM C1071.
  12. Unit casing shall be capable of withstanding 500-hour salt spray exposure per ASTM B117 (scribed specimen).
  13. Roof curb shall be designed to conform to NRCA Standards.
  14. Unit shall be subjected to a completely automated run test on the assembly line. The data for each unit will be stored at the factory, and must be available upon request.
  15. Unit shall be designed in accordance with UL Standard 1995, including tested to withstand rain.
  16. Unit shall be constructed to prevent intrusion of snow and tested to prevent snow intrusion into the control box up to 40 mph.
- B. Delivery, Storage, and Handling:
1. Unit shall be stored and handled per manufacturer's recommendations.
  2. Unit shall only be stored or positioned in the upright position.
- C. Operating Characteristics:
1. Unit shall be capable of starting and running at 125°F (52°C) ambient outdoor temperature, meeting maximum load criteria of AHRI Standard 210/240 or 340/360 at ± 10% voltage.
  2. Compressor with standard controls shall be capable of operation down to 30°F (−1°C), ambient outdoor temperatures. Accessory Low Ambient controls are available if mechanically cooling at ambient temperatures below 30°F (−1°C).
  3. Unit shall be capable of simultaneous heating duty and defrost cycle operation when using accessory electric heaters.
- D. Unit Cabinet:
1. Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with a pre-painted baked enamel finish on all externally exposed surfaces.
  2. Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 340/360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum 1/2-in. thick, 1 lb density, flexible fiberglass insulation, neoprene coated on the air side. Aluminum foil-faced fiberglass insulation shall be used in the heat compartment.

Packaged Outdoor Central-Station Air-  
Handling Units  
23 74 13 - 3

3. Unit internal insulation linings shall be resistant to mold growth in accordance with "mold growth and humidity" test in ASTM C1338, G21, and UL 181 or comparable test method. Air stream surfaces shall be evaluated in accordance with the "Erosion Test" in UL 181, as part of ASTM C1071.
  4. Condensate Pan and Connections:
    - a. Shall be a sloped condensate drain pan made of a non-corrosive material.
    - b. Shall comply with ASHRAE Standard 62.
  5. Gas Connections:
    - a. All gas piping connecting to unit gas valve shall enter the unit cabinet at a single location.
  6. Electrical Connections:
    - a. All unit power wiring shall enter unit cabinet at a single, factory-prepared, knockout location.
  7. Component Access Panels (standard):
    - a. Cabinet panels shall be easily removable for servicing.
- E. Coils:
1. Standard Aluminum Fin/Copper Tube Coils:
    - a. Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.
  2. Optional Pre-Coated Aluminum-Fin Condenser Coils:
    - a. Shall have a durable epoxy-phenolic coating to provide protection in mildly corrosive coastal environments.
    - b. Corrosion durability of fin stock shall be confirmed through testing to be no less than 1000 hours salt spray per ASTM B117-90.
- F. Refrigerant components:
1. Refrigerant circuit shall include the following control, safety, and maintenance features:
    - a. Thermostatic Expansion Valve (TXV) shall help provide optimum performance across the entire operating range. Shall contain removable power element to allow change out of power element and bulb without removing the valve body.
      - 1) Refrigerant filter drier on each refrigerant circuit.
      - 2) Service gauge connections on suction and discharge lines.
      - 3) Suction line accumulator to provide protection in all operating modes from cooling, heating and reverse cycle switching. Standard on each refrigerant circuit.
  2. Compressors:
    - a. Unit shall use fully hermetic, scroll compressors.
      - 1) Compressor motors shall be cooled by refrigerant gas passing through motor windings.

- 2) Compressors shall be internally protected from high discharge temperature conditions.
  - 3) Compressors shall be protected from an overtemperature and over-amperage conditions by an internal, motor overload device.
  - 4) Compressor shall be factory mounted on rubber grommets.
  - 5) Compressor motors shall have internal line break thermal, current overload and high pressure differential protection.
  - 6) Crankcase heaters shall be utilized on all models to protect compressor with specific refrigerant charge.
- G. Filter section:
1. Shall consist of factory-installed, low velocity, throw-away 2-in. thick fiberglass filters.
  2. Filters shall be standard, commercially available sizes.
- H. Evaporator fan and motor:
1. Evaporator fan motor:
    - a. Shall have permanently lubricated bearings.
      - 1) Shall have inherent automatic-reset thermal overload protection or circuit breaker.
      - 2) Shall have a maximum continuous bhp rating for continuous duty operation; no safety factors above that rating shall be required.
  2. Evaporator fan:
    - a. Blower fan shall be double inlet type with forward curved blades.
      - 1) Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.
- I. Condenser Fans and Motors:
1. Condenser fan motors:
    - a. Shall be a totally enclosed motor.
      - 1) Shall use permanently lubricated bearings.
      - 2) Shall have inherent thermal overload protection with an automatic reset feature.
  2. Condenser fans:
    - a. Shall be a direct driven propeller type fan and shall be dynamically balanced.
- J. Special features, options, and accessories:
1. Head pressure control package:
    - a. Controller shall control coil head pressure by condenser fan speed modulation or condenser fan cycling and wind baffles.
    - b. Shall consist of solid state control and condenser coil temperature sensor to maintain condensing temperature between 90°F (32°C)

and 110°F (43°C) at outdoor ambient temperatures down to –20°F (–29°C).

2. Condenser Coil Hail Guard Assembly:
  - a. Shall protect against damage from hail.
  - b. Shall be louvered style design.
3. Economizer:
  - a. Independent modules for vertical or horizontal return configuration shall be available. Vertical return modules shall be available as a factory-installed option.
  - b. Ultra low leak design meets California Title 24 and, ASHRAE 90.1 and IECC requirements.
  - c. Shall be capable of introducing up to 100% outdoor air.
  - d. The economizer controller shall also provide control of an accessory power exhaust unit function. Factory set at 100%, with a range of 0% to 100%.
  - e. Shall include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below setpoints.
  - f. Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.
  - g. Shall be equipped with a barometric relief damper capable of relieving up to 100% return air and contain seals that meet ASHRAE 90.1-2016 and IECC-2015 requirements.
  - h. Shall be designed to close damper(s) during loss-of-power situations with spring return built into motor.
  - i. Dampers shall be completely closed when the unit is in the unoccupied mode.
  - j. Integrated, gear driven opposing modulating blade design type capable of simultaneous economizer and compressor operation.
  - k. Combined minimum and DCV maximum damper position potentiometers with compressor staging relay.
  - l. On-board Fault Detection and Diagnostics (FDD) that senses and alerts when the economizer is not operating properly, per California Title 24.
  - m. Dry bulb outdoor air temperature sensor shall be provided as standard. Enthalpy sensor is also available on factory-installed only. Outdoor air sensor setpoint shall be adjustable and shall range from 40 to 100°F (4 to 38°C). Additional sensor options shall be available as accessories.
4. Propeller power exhaust:
  - a. Power exhaust shall be used in conjunction with an integrated economizer.
  - b. Independent modules for vertical or horizontal return configurations shall be available.

Packaged Outdoor Central-Station Air-  
Handling Units  
23 74 13 - 6



- c. Horizontal power exhaust shall be mounted in return ductwork.
  - d. Power exhaust shall be controlled by economizer controller operation. Exhaust fans shall be energized when dampers open past the 0 to 100% adjustable setpoint on the economizer control.
- 5. Roof curbs (vertical):
  - a. Formed galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight.
  - b. Permits installation and securing of ductwork to curb prior to mounting unit on the curb.
- 6. Anti-short Cycle Timer:
  - a. Shall prevent compressor short cycling by providing a 5-minute delay ( $\pm 2$  minutes) before restarting a compressor after shutdown for any reason.
  - b. One device shall be required per compressor.
- 7. Electric Heat:
  - a. Heating Section:
    - 1) Heater element open coil resistance wire, nickel-chrome alloy, 0.29 inches inside diameter, strung through ceramic insulators mounted on metal frame. Coil ends are staked and welded to terminal screw slots.
    - 2) Heater assemblies are provided with integral fusing in the single point box (if applicable) for protection of internal heater circuits not exceeding 48 amps each. Electric heaters use a combination of 24v control side break/auto-reset, line-break/non-resettable "one shot" limit switches to protect the unit against over-temperature situations. All heaters use magnetic heater contactors (24 v coil) and terminal block all mounted in electric heater control box (minimum 18 ga galvanized steel) attached to end of heater assembly.
- 8. Hinged Access panels:
  - a. Shall provide easy access through integrated quarter turn latches.
  - b. Shall be on major panels of filter, control box, fan motor and compressor.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Verify that proper power supply is available.

#### **3.2 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NFPA 90A.

- C. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

### **3.3 SYSTEM STARTUP**

- A. Provide factory start-up and supervise installation by Contractor.

**END OF SECTION**

**SECTION 23 81 26**  
**SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Air-source heat pumps.
- B. Indoor air handling (fan and coil) units for ductless systems.

**1.2 RELATED REQUIREMENTS**

- A. Section 23 31 00 - HVAC Ducts and Casings.

**1.3 REFERENCE STANDARDS**

- A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.
- B. AHRI 270 (SI/I-P) - Sound Performance Rating of Outdoor Unitary Equipment; 2025.
- C. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.
- D. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2022, with Addendum (2024).
- E. ASHRAE Std 23 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units; 2022.
- F. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017, with Addendum (2022).
- G. ASHRAE Std 103 - Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers; 2022.
- H. NEMA MG 00001 - Motors and Generators; 2024.
- I. NFPA 54 - National Fuel Gas Code; 2024.
- J. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
- K. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.
- L. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances; 2024.
- M. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.
- N. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

**1.4 SUBMITTALS**

- A. See Division 1 specifications for submittal procedures.
- B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
- D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
- E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- F. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

## **1.5 QUALITY ASSURANCE**

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

## **1.6 WARRANTY**

- A. See Division 1 for additional warranty requirements.
- B. Provide five year manufacturers warranty for compressors.

# **PART 2 PRODUCTS**

## **2.1 MANUFACTURERS**

- A. Mitsubishi Electric: [www.mitsubishicomfort.com](http://www.mitsubishicomfort.com)
- B. Carrier Corporation: [www.carrier.com/#sle](http://www.carrier.com/#sle).
- C. Trane Inc: [www.trane.com/#sle](http://www.trane.com/#sle).

## **2.2 SYSTEM DESIGN**

- A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
  - 1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator; auxiliary electric heat.
  - 2. Heating: Natural gas fired.
  - 3. Cooling: Outdoor electric condensing unit with evaporator coil in central ducted indoor unit.
  - 4. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.
- B. Performance Requirements: See Drawings for additional requirements.

## **2.3 INDOOR AIR HANDLING UNITS FOR DUCTLESS SYSTEMS**

Small-Capacity Split-System Air  
Conditioners  
23 81 26 - 2

- A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.
- B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
  - 1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
  - 2. Manufacturer: System manufacturer.

## **2.4 OUTDOOR UNITS**

- A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
  - 1. Comply with AHRI 210/240.
  - 2. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
  - 3. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23 and UL 207.
- B. Compressor: Hermetic, two speed 1800 and 3600 rpm, AHRI 520 resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high-pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.
- C. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
- D. Accessories: Filter drier, high-pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
  - 1. Provide thermostatic expansion valves.
  - 2. Provide heat pump reversing valves.
- E. Operating Controls:
  - 1. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig and off when pressure drops below 140 psig for operation to 0 degrees F.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.
- B. Verify that proper power supply is available and in correct location.
- C. Verify that proper fuel supply is available for connection.

### **3.2 INSTALLATION**

Small-Capacity Split-System Air  
Conditioners  
23 81 26 - 3

- A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.
- B. Install in accordance with NFPA 90A and NFPA 90B.
- C. Install refrigeration systems in accordance with ASHRAE Std 15.

**END OF SECTION**

**SECTION 26 05 00  
COMMON WORK RESULTS FOR ELECTRICAL**

**PART 1 - GENERAL**

**1.1 CONTRACT PROVISIONS**

- A. The requirements of this Section are in addition to the requirements of Division 1, General Conditions and Supplementary Conditions.

**1.2 SUMMARY**

- A. This section describes the requirements for the electrical work includes, among others, the furnishing and installation of the following:
1. Electrical service from the Main Switchboard to the building Distribution Panel(s) including transformer(s), conduit and trenching, conductors.
  2. Power distribution system.
  3. Grounding system.
  4. Lighting and lighting control systems.
  5. Wiring systems including power wiring to plumbing and HVAC and other misc. appliances and equipment.
  6. Electrical services (power) for Communications management system. (voice/video/media/clock) as described in Division 27 and as indicated on the drawings.
  7. Electrical services (power) for Computer data systems, as described in Division 28 and as indicated on the drawings to include outlets, raceways, and cabling.
  8. Electrical services (power) for Intrusion alarm and security systems as described in Division 28 and as indicated on the drawings.
  9. Emergency egress lighting.
  10. Photovoltaic System.
  11. Testing and commissioning for all electrical work installed under this contract and as described in these specifications and indicated on the drawings.
- B. Furnish and install all electrical equipment and systems as shown on the Drawings and as described in this Division of the Specifications to provide a complete and functional electrical installation. This work includes but is not limited to all material and labor required for installation of electrical and special systems complete as described herein this specification and drawings; and connections (and installation where not otherwise provided for) of electrical equipment furnished by others. Provide and install all items of equipment, devices, supports, etc., which are incidental to the major components shown on the Drawings or described in these Specifications.

**1.3 DEFINITIONS**

- A. The meaning of words shall be as defined in the CEC Article 100, Definitions, unless defined otherwise in an individual specification section.

- B. The following specification development organizations are referenced throughout the various specification sections of Division 26:
1. ADAAG – Americans with Disabilities Act Accessibility Guidelines.
  2. ANSI – American National Standards Institute.
  3. ASME – American Society of Mechanical Engineers.
  4. ASTM – American Society for Testing and Materials.
  5. FCC – Federal Communications Commission.
  6. ICC - International Code Council
  7. 21. IEEE – Institute of Electrical and Electronic Engineers.
  8. ISO – International Organization for Standardization.
  9. 27. NECA – National Electrical Contractors Association.
  10. 28. NEMA – National Electrical Manufacturing Association.
  11. 29. NETA – National Electrical Testing Association.
  12. 30. NFPA – National Fire Protection Association.
  13. 32. OSHA – Occupational Safety and Health Administration.
  14. 34. UL – Underwriters Laboratories.

#### **1.4 RELATED WORK INCLUDED IN OTHER DIVISIONS**

- A. Finish painting except factory applied finishes and repair of factory finishes shall be provided in accordance with appropriate sections of this Specification. Coordinate "painting" requirements of this Division with other trades as required to assure timely and satisfactory completion of required work. In finished areas, all exposed raceway, boxes, galvanized steel box covers (where allowed), and other electrical "structure" shall be finished to match adjacent structures. Verify that all raceway openings are closed and box covers are in place prior to finishing work done by others.
- B. Examine the drawings and specification for mechanical and plumbing equipment and provide electrical installation for heating, ventilation and air conditioning equipment, motors, pumps and associated motor starters and controls as described in Division 22 and Division 23.
- C. Examine the Architectural drawings and specification for electrical appliances and equipment which may not be shown on the plans to include and provide electrical installations as described in the architectural division of work.
- D. Examine the Architectural drawings and provide all construction necessary to maintain the integrity of the fire rated barriers.
- E. Examine the Architectural drawings and coordinate with the Architect to provide access doors, whether shown on drawings or not, where floors, walls, or ceiling must be penetrated for access to electrical equipment, outlet boxes, devices, etc., and as specified in this specification.
- F. Provide and install, as part of the work described in this Division, all power and control wiring fed from a source of 30 Volts or more (i.e. all wiring except temperature control wiring) for mechanical equipment described in Division 23.



- G. Examine the fire sprinkler system drawings and specifications for electrical work which may not be shown on the electrical and/or fire detection and alarm plans to be included in the electrical work as necessary as described in the Division 21 fire sprinkler system.

## **1.5 APPLICATION OF OTHER DIVISIONS**

- A. Where carpentry, masonry, concrete work, painting, etc., is required in the installation of equipment specified under this Division, the work shall be done in accordance with the applicable Division of these Specifications. This work could include for example: work associated with panelboard installation, equipment pads or bases, support structures, etc.

## **1.6 DRAWINGS AND SPECIFICATIONS**

- A. The information presented in these Specifications, and on the drawings, is intended to describe the utilitarian and physical aspects of the systems shown as well as the quality of the entire installation. All information is as complete and thorough as possible, but every condition or situation cannot be anticipated. Exact locations, dimensions, elevations, etc. must be determined "on the job" with careful attention to the "intent" of the Drawings and Specifications.
- B. The above paragraph shall not be construed as to allow significant deviation from either the Drawings or Specifications without prior approval of the Architect, but minor changes in conduit routing or equipment locations may be required or desired due to specific conditions encountered. This work shall be accomplished in accordance with these Specifications and no "extra charges" are to be created for any unanticipated labor or material.
- C. Any error or omissions of detail in either the drawings or the specifications shall not relieve the Contractor from correctly installing all materials necessary for complete and operating electrical systems.
- D. Contractor shall inspect the site and verify all measurements and conditions. No extra compensation will be allowed because of differences between work shown on the drawings and measurements at the site.
  - 1. The Drawings are diagrammatic in nature, but the locations of devices, equipment, outlets, and lighting fixtures are shown approximately where installations are intended. Architectural, structural, mechanical, audio/video, theatrical lighting and other drawings shall be examined, noting all conditions that may affect this work. Report conflicting conditions to the Architect/Engineer for adjustment before proceeding with the work. Should the Contractor proceed with work without reporting the matter, he does so on his own responsibility and shall alter work if directed by the Architect/Engineer at his own expense.
- E. Examine the architectural, structural, mechanical, fire sprinkler and manufacturer's drawings for various equipment in order to determine exact routing and final terminations for all conduits and cables. Conduits shall be stubbed up as near as possible to equipment enclosure.

- F. All equipment shall be located and installed so that it will be readily accessible for operation and maintenance. The Owner reserves the right to require minor changes in location of outlets or equipment, prior to rough in without incurring any additional cost or changes.
- G. If significant departures from the Drawings or Specifications are considered necessary by the Contractor, details of the changes and the reasons therefore shall be submitted to the Architect as within thirty days after award of contract. Prior written acceptance of the Architect is required for these departures.
- H. Clarification of plans and specifications for the purpose of facilitating construction, but not involving additional labor and materials, may be prepared during construction by the Architect/Engineer. Said revised plans and specifications shall become a part of the contract. The Contractor shall conform to the revised plans and specifications at no additional cost to the Owner.

#### **1.7 CODES, STANDARDS, RULES AND REGULATIONS**

- A. All work and materials shall be in full accordance with the latest rules, codes, and/or regulations and not limited to the following:
- B. California Building Standards Code (California Code of Regulations - Title 24)
- C. NFPA 70 - National Electrical Code; National Fire Protection Association, 2020 with 2022 California Electrical Code amendments
- D. NFPA 72 - Fire Alarm Code
- E. NFPA 101 - Life Safety Code
- F. City and County Electrical Codes as applicable.
- G. Utility rules and regulations.
- H. Any applicable additional codes and regulatory documents effective at the project site.
- I. Nothing on the Drawings or in the Specifications shall be construed to allow work not in conformance with these rules, codes, and regulations.
  - 1. The Drawings and/or Specifications shall take precedence where work and material described therein exceeds that required by rules, codes, or regulations.

#### **1.8 MANUFACTURER'S INSTRUCTIONS**

- A. Follow the manufacturer's instructions when specific installation or connection details are not indicated or specified on the contract documents.
- B. Notify the Architect/Engineer of conflicts between the manufacturer's instructions and installation or connection details prior to the installation of materials.

#### **1.9 WORKMANSHIP**

- A. High quality workmanship shall be evidenced in the installation of all electrical equipment and materials. Use the National Electrical Contractors Association's

"Standard of Installation" as a guide to the workmanship required. Be prepared to replace or repair any material or equipment damaged by or installed in a manner exhibiting evidence of poor workmanship.

#### **1.10 COORDINATION WITH OTHER TRADES**

- A. Examine the Electrical Drawings and refer to the Drawings and Specifications describing other work to be accomplished. Verify and coordinate prior to bid. Continue to coordinate work planning and all work in the field to avoid conflicts, errors, and/or delays. No compensation will be allowed for extra work necessitated by lack of coordination.

#### **1.11 AUTHORITY OF THE ARCHITECT**

- A. As used in this paragraph only, the word "Architect" shall mean the Architect of record or his designated representative.
- B. The authority of the Architect shall be absolute with respect to all performance under this Specification. In case of dispute, the decision of the Architect shall be final.
- C. Where optional materials, methods, or installation techniques are allowed under the provisions of this Specification, they may be used at the discretion of the Architect. The Architect may require specific materials, methods, or techniques to be used in specific situations where use of other materials, methods, or techniques might in his judgment result in loss of aesthetics, accidental damage, life safety hazard, or loss of utility over the system design lifetime.
- D. No additional charges will be allowed for work or material require to be supplied under the conditions of this paragraph unless the need for such material or work could not have been anticipated by thorough study of the site, Drawings, and Specifications and knowledge of all applicable codes, laws, and ordinances.

#### **1.12 EXAMINATION OF THE SITE**

- A. The contractor is required to visit the site of construction prior to bid to determine existing conditions and their effect upon the work he will be required to perform. No additional compensation will be allowed for any extra expenses incurred by failure to detect and evaluate all existing conditions that will affect his work to be included in the bid to accomplish this contract document's goal.

#### **1.13 STRUCTURAL REQUIREMENTS**

- A. Secure all anchors for electrical equipment in a manner, which will not decrease the structural value of any structure to an unsafe level. Install all equipment, fixtures, etc. to resist seismic movements. Inform the Architect in advance and provide drawings of any proposed modifications to the structure that involves cutting or patching of concrete, masonry, steel, or wood in this project.

#### **1.14 PERMITS, FEES, AND, INSPECTIONS**

- A. Obtain all permits and licenses as required and pay all fees incidental to construction.

- B. Inspections required by prevailing Local Authorities, and/or ordinances, shall be coordinated and arranged by the contractor. Provide the Architect with a schedule of inspections, where applicable, and submit all certificates of inspection to the Architect.
- C. The Contractor shall cooperate with the Architect and shall provide assistance at all times for the inspection of the electrical work. Remove covers, operate equipment, or perform any reasonable work, which, in the opinion of the Architect, will be necessary to determine the quality or adequacy of the work. Work shall not be closed in or covered before inspection and approval by the Architect. Cost of uncovering and making repairs where un-inspected work has been closed in shall be borne by the Contractor. If any material does not conform with these specifications the Contractor shall, within three days after being notified by the Architect, remove the materials from the premises.

#### **1.15 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials and equipment to project site in manufacturer's original packaging with labeling showing product name, brand, model, project name, address, and Contractor's name. Store in a location as agreeable to the Owner. Secure material from weather or accidental damage.

#### **1.16 SEQUENCING AND SCHEDULING**

- A. Sequence work under provisions of Division 1.
- B. Coordinate the incoming electrical, telephone and cable television services with the local serving utility companies. Install utility service trench and duct systems in accordance with the respective serving utility company requirements.
- C. Coordinate hand hole locations with the existing site conditions. Hand holes are to be located approximately five feet from building or as indicated on drawings.

#### **1.17 SHORT CIRCUIT AND PROTECTIVE DEVICE COORDINATION STUDY**

- A. The contractor shall provide short circuit, protective device and arc flash studies for the complete electrical distribution system. Submit to the Electrical Engineer of Record for review. Provide all short circuit device and equipment characteristic information for all electrical components. Provide Time-Current curves for all overcurrent protective devices in the submittal. Set and adjust all devices in accordance with the results of this study prior to energizing equipment. Refer to Section 26 05 73, Power Systems Studies for additional requirements.
- B. The Contractor shall be responsible for obtaining all pertinent information necessary in order to perform the required short circuit, protective device coordination and arc flash studies to include but not limited to the following:
  - 1. Contacting the serving power utility to obtain the available short circuit current at the project point of connection and/or secondary of the serving utility company service transformer(s).
  - 2. Field investigation to determine the short circuit current rating for any existing electrical service and distribution equipment.

3. Electrical characteristics for all proposed new electrical service and distribution equipment.
4. The Contractor shall provide approved permanent labels for all electrical service and distribution equipment to clearly identify the available short circuit current and arc flash energy levels and required PPE (Personnel Protective Equipment).

#### **1.18 OPERATING INSTRUCTIONS**

- A. Instruct the Owner as to function, operation, maintenance, and adjustment of each system and piece of equipment provided.

#### **1.19 RECORD DRAWING**

- A. The Contractor shall keep a separate set of Electrical Drawings at the job site to be used as RECORD Drawings. These Drawings are to be kept current and in a neat and clean condition at all times. They are to be available for inspection by the Architect or Engineer at any time during site visitations. These Drawings shall be "red lined" to indicate all changes in equipment, device, and outlet locations; and to indicate the true locations of all concealed or underground work where different from that shown on the Drawings. Each sheet of this set shall be clearly and permanently marked "RECORD DRAWINGS".
- B. Upon completion of the project and prior to final payment, transfer all RECORD DRAWINGS information to the provided original drawings. All information shall be clearly drawn with "RED" ink. The drawings shall be scanned, 100% edited, and converted into an AutoCAD ".dwg" version 2011 (or higher) electronic file. Deliver the original, final sets, and electronic files (CD) to the Architect for review and delivery to the Owner.

#### **1.20 SPARE PARTS**

- A. Spare parts shall be provided and maintained by the Contractor to support the maintenance response requirements defined in this document.
- B. At a minimum, the following spare parts shall be stored onsite at a location identified by the Owner's representative. The spare parts shall be the property of the Owner. The spare parts shall be of the same type submitted and installed in the facility to include the following:
- C. Lighting fixture LED driver, one for each fixture type.
- D. Branch circuit panelboard circuit breaker, one for each circuit breaker type.
- E. Fuses, one set of three for each fuse type and size.
- F. Lighting occupancy sensors and switches, one for each sensor and switch type.

#### **1.21 GUARANTEE**

- A. All electrical work, material, and equipment shall be guaranteed to be free from defects in workmanship or material for a period of two (2) year from the date of final acceptance. Repair or replace all such defects in a timely manner and any damage to the owner's property resulting from such defect or repair thereof. All

equipment and material provided and all work accomplished under the requirements of this section shall be at no expense to the Owner.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Unless specifically indicated otherwise, all material shall be new and free from defects; it shall be listed by Underwriters' Laboratories where applicable. Like items shall be of the same manufacturer (except lighting fixtures - which shall be as specified).
- B. Except as noted otherwise, where material of a particular manufacturer is specified, the intent is to describe the quality and function of the item. The term "...or acceptable equal" is implied. A substitution of any of these items will require that the item be presented in a submittal whether specifically listed in the "Submittals" paragraph below or not.

### **2.2 SUBMITTALS**

- A. Material submittals shall be complete and submitted all at the same time. The individual groups of submittal types (e.g.: lighting fixtures, wiring devices, distribution equipment, etc.) MUST be prefaced with a list of contents identifying each item by its project name or symbol, manufacturer, and complete catalog number. Each copy of each submittal group shall have the list of contents attached. These lists will be used to report submittal comments. The Contractor is responsible for submitting this information in a timely manner so that material may be ordered early enough to meet the construction schedule. If material is not ordered in time for whatever reason, pay such premium prices and special handling charges as are required to meet the construction schedule. No substitution of an "accepted" item will be allowed due to failure to plan for adequate material procurement lead time.
- B. Shop drawings shall be drawn to scale or completely dimensioned and shall give all information required to completely describe the item. The Contractor shall carefully check all the shop drawings for compliance with these specifications and the Plans.
- C. If the shop drawings show variations from the Contract requirements because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in order that if (acceptable) suitable action may be taken for proper adjustment of the Contract. The Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract, even though the shop drawings have been reviewed.
- D. Work requiring shop drawings shall not be started before receipt of the Architect's review and acceptance.
- E. The Architect's/Engineer's review of the submitted materials, items and shop drawings are for general compliance with the plans and specifications and general design and arrangement only. Therefore, it shall not relieve the Contractor from responsibility for errors of any sort in the materials, items, shop

drawings or schedules. The Contractor shall verify all dimensions and job site conditions affecting the work, and shall be responsible for furnishing and installing the proper materials required by the Contract, whether or not indicated on the drawings and specifications.

- F. As a minimum, submittals are required for the following items:
  - 1. RACEWAY COMPONENTS
  - 2. WIRE AND CABLE
  - 3. WIRING DEVICES
  - 4. MAIN SWITCHBOARD AND DISTRIBUTION PANELS
  - 5. PANELBOARDS
  - 6. PHOTOVOLTAIC SYSTEM
  - 7. PULL BOXES
  - 8. SAFETY SWITCHES, DISCONNECTS AND CIRCUIT BREAKERS
  - 9. TRANSFORMERS
  - 10. LIGHTING FIXTURES, CONTROL SYSTEMS, PEDESTALS AND POLES

## **2.3 SUBSTITUTIONS**

- A. Specific brand names and catalog numbers are used to describe materials in order to establish of performance and quality.
- B. Only one substitution will be considered for any item. Substitute materials must be equal in quality and function to that specified. Allowance of a substitution does not permit any reduction of system performance or utility, and the Contractor is responsible for additional costs incurred due to use of a substituted item. If the proposed substitute item is "rejected", the specified item shall be provided (re-submittal required) without further discussions or delay.
- C. Any Contractor's proposed substitution of material, article, or method in the opinion of the Architect/Engineer are equal to that specified will be accepted, provided the Contractor submits a single written request, in triplicate, to the Architect, with the following information for each item:
  - D. Name of Manufacturer or supplier.
  - E. Trade or brand names.
  - F. Type, model, style, and/or catalog number.
  - G. Size or capacity rating.
- H. After receipt of a written request from the contractor, the engineer of record will review product substitutions fourteen (14) days prior to the bid date. If system substitutions are submitted after the award of the project contract, the analysis for the whole system substitution will be charged to the contractor at senior engineer hourly rates.
- I. The decision of the Architect/Engineer shall govern as to what is equal to the item specified in the plans and specifications. Equality will be judge on the basis of the following:

1. Conformance with description or performance required.
  2. Equal in quality.
  3. Comparable in appearance and artistic effect where these are in considerations.
  4. Comparable operation, maintenance and performance.
  5. Equal in longevity and service under conditions of climate and usage.
  6. Conformance with space allocations and requirements for operations from in details and construction of related work.
  7. Conformance with all applicable codes and regulations.
- J. If the Architect/Engineer considers it necessary, tests to determine the quality of the proposed materials shall be made, at the expense of the Contractor, by an unbiased laboratory, satisfactory to the Architect.

## **2.4 ENCLOSURES**

- A. Provide enclosures suitable for the specific type of location in which they are installed.
1. Provide NEMA 1 or NEMA 12 boxes and enclosures for dry locations. Dry locations are all indoor areas that do not fall within the definitions below for wet or damp locations.
  2. Provide NEMA 3R boxes and enclosures for wet locations. Wet locations are all locations exposed to weather, whether under a roof or not.
  3. Provide NEMA 4 boxes and enclosures for damp locations. Damp locations are all indoor spaces wholly or partially underground or any area subject to water spray.
  4. Provide NEMA 4X, stainless steel enclosures in all kitchen and wash down areas.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. All equipment shall be set square and plumb, securely mounted, adequately supported, and permanent. Provide workspace around items of electrical equipment as required by California Electrical Code (CEC). In general, equipment is to be installed in accordance with manufacturer's instructions; but the requirements of these specifications shall take precedence where conflicts exist.
- B. WIRING METHODS: The cables and conductors of all systems specified in the Specification are required to be installed in raceway.
- C. Coordinate electrical work with the Owner's representative and work of other trades to avoid conflicts, errors, delays, and unnecessary interference with operation of the facility during construction.
- D. Check and coordinate the approximate locations of electrical stub-ups, light fixtures, electrical outlets, equipment, and other electrical system components shown on the Drawings for conflicts with openings, structural members, and components of other systems and equipment having fixed locations. In the



event of conflicts, notify the architect in writing. The architect's decision shall govern. Make modifications and changes required to correct conflicts as required.

### **3.2 ELECTRICAL WORK FOR EQUIPMENT PROVIDED UNDER OTHER SECTIONS**

- A. Install power conductors and terminate on equipment provided under other specification sections. Verify specific requirements.
- B. Install and terminate electrical controls as described on the Electrical Drawings (For mechanical equipment specified in Division 23).
- C. Line voltage control wiring of exhaust fans is to be accomplished under this Division. The controlling device may be specified elsewhere.
- D. Provide and install all disconnect/safety switches and motor starters except those devices specified to be furnished with equipment specified elsewhere.
- E. Unless provided for in another Division, install all items of electrical equipment provided by others.
- F. Assist others in equipment testing to verify that wiring and connections made under this Division are correct.

### **3.3 EQUIPMENT IDENTIFICATION**

- A. Nameplates shall be installed on all items of electrical equipment as follows: switchboard(s) and switchboard circuit breakers, panelboards, terminal cabinets, time switches, contactors, motor control switches, wall switches (where noted on the Drawings), motor starters provided under this Division where the function is not immediately obvious, and safety switches.
- B. The nameplate shall identify the item by Drawing name where applicable and describe its use or function in this installation.
- C. Permanently mark all utility outlets to show source of power panel and circuit breaker number.
- D. Provide nameplates per Section 26 05 53.

### **3.4 EXCAVATION AND BACKFILL**

- A. Excavation and backfill shall be accomplished as required for installation of electrical equipment as shown on the Drawings. Restore all surfaces, roadways, walks, etc., and any existing underground structures which might be disturbed during this work to their original condition in a manner acceptable to the Architect.
- B. Trenches shall be straight except where otherwise indicated. Depth shall be as noted on the Drawings and at least as required to provide the minimum cover specified by applicable codes and regulations for the equipment installed. Bottom of trench shall be smooth and free of any rock points. Place a 4" sand bed in trench if these conditions cannot be met with native material.

- C. Backfill shall be clean and free of rocks and debris. Backfill is to be tamped in 6" layers to nominal 95% compaction using a mechanical tamper manufactured specifically for this purpose. In an area of engineered fill or other area of specified compaction, backfill shall be compacted to match that specified for that area.
- D. At a depth of 12" below finished grade and at least 6" above installed equipment, lay a 6" wide red warning tape on the compacted backfill for the full length of the trench. Do not stretch the tape. Use Brady "Identoline" stating: "CAUTION BURIED ELECTRICAL LINE". Installation under building slabs is not required unless noted otherwise.
- E. If at any time during a period of one-year dating from the date of final acceptance of the project, there shall be any settlement of conduit trenches, the Architect may notify the Contractor to immediately provide additional fill and to make such repairs or replacements in paving, planting, or structures, as may be deemed necessary at the Contractor's expense.
- F. Cooperate and coordinate with others in planning for and execution of all trench work.
  - 1. The Contractor is expected to exercise due care when excavating in an area of existing utilities to avoid damage to these facilities. Where it can be determined that underground facilities are likely to exist (either from the Drawings or inspection of the site), the Contractor is required to determine the exact locations of these existing installations. Damage to existing facilities, due to failure to properly accomplish the above, shall be repaired at the Contractors expense to the approval by the Architect and satisfaction of the Owner.
  - 2. Call an underground service firm before digging.

### **3.5 SEALING PENETRATIONS**

- A. Flash and counter flash roof and wall penetrations with equipment manufactured for the purpose and as described in other Divisions of these Specifications or as Directed by the Architect. Apply mastic as required to seal absolutely watertight.
- B. Conduits penetrating floor slabs or block or concrete walls shall be grouted and sealed watertight.

### **3.6 CUTTING AND PATCHING**

- A. Obtain the Architect's acceptance prior to cutting existing surfaces or surfaces under construction. All such surfaces must be repaired or patched to the satisfaction of the Architect.

### **3.7 EQUIPMENT ANCHORING**

- A. Seismic Withstand Requirements: Freestanding or wall-hung equipment shall be anchored in place by methods, which will meet the requirements of the applicable codes for seismic loads. The contractor shall submit calculations in accordance with "Contractor Submittals", for the design of the anchoring

systems for all equipment, including panels, transformers, etc. in excess of 250 pounds. Calculations shall be performed, signed and stamped by a Structural Engineer or a Civil Engineer experienced in structural design and licensed in the State of California. The calculation shall provide an analysis of lateral and overturning forces and shall include a factor of safety against overturning equal to 1.5. The calculation shall also provide an analysis of both the anchoring system and the foundation or wall system to receive the anchor loads and shall show that the foundation is capable of resisting all anchor loads. Submittal shall include data on attachment hardware and methods that will satisfy withstand criteria.

- B. Seismic bracing for light fixtures cable or pendant suspended from ceiling or roof structure shall be seismically braced to prevent fixture from swaying 45 degree in either direction of suspension point. Contractor shall use same cable used to suspend light fixture. Where pendants are use the contractor shall use air craft light fixture suspension cable. Submittal shall include data on attachment hardware and methods that will satisfy withstand criteria referred to in above paragraph.

### **3.8 HOUSEKEEPING PADS AND FOUNDATIONS**

- A. Concrete work required for housekeeping pads and foundations shall be provided by General Construction Work.
- B. Furnish required dimensional drawings and specify locations for all equipment pads and foundations. Minimum height of housekeeping pads shall be four inches and shall extend out six inches from the footprint of the equipment. Extend pad dimensions where required to maintain accessibility and meet all code requirements.
- C. Furnish anchor bolts and sleeves, verify accuracy of installation.
- D. Provide housekeeping pads for the following:
  - 1. Other equipment as required or as noted on the drawings.

### **3.9 PROTECTION CLEANING AND REPAIRS**

- A. All electrical equipment shall be protected from damage or degradation during construction. Electrical equipment stored or installed shall be protected from dust, water, or damage from other sources.
- B. After all other work has been accomplished, such as plastering, painting, etc., and prior to final review by the Architect; all electrical equipment, especially equipment enclosures, panelboards, switchboards, and lighting fixtures shall be thoroughly cleaned (inside and out) of all dirt, water, grease, plaster, paint, or other construction debris. All surfaces shall be clean and in "new" condition. All scratches, dents, marks, cracks, etc., shall be repaired to the satisfaction of the Architect or the equipment shall be replaced at no additional cost.

### **3.10 ELECTRICAL EQUIPMENT DELIVERABLES**

- A. Retain and safeguard all detachable and spare devices, equipment, and literature (O&M manuals, instruction books, wiring diagrams, test reports, keys,

fixtures, etc.) until completion of work. At this time, all items will be delivered to the Owner as directed by the Architect.

### **3.11 TESTS**

- A. Take precaution during the testing period to insure the safety of personnel and equipment.
- B. Test all wiring for continuity and grounds before any fixtures or equipment are connected. Where such tests indicate faulty installation or other defects, the fault(s) shall be located and repaired at the Contractor's expense. The repaired installation shall then be retested.
- C. Verify rotation of all three phase motors and reconnect if necessary.
- D. Verify the resistance of the grounding electrode system(s).
- E. Balance all loads on each panelboard and all other types of distribution equipment as applicable.

### **3.12 ADJUSTING**

- A. Inspect all equipment and put into good working order.

### **3.13 CLEANING**

- A. Clean work under provisions of Division 1.
- B. Clean all electrical items. Fixtures and equipment shall be free of dirt, dust and other construction debris.

### **3.14 START UP**

- A. Operate all electrical systems in good working order for a period of five consecutive days at a time period agreed to by the Owner's representative.

**SECTION 26 05 19**  
**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Single conductor building wire.
- B. Wiring connectors.
- C. Electrical tape.
- D. Heat shrink tubing.
- E. Oxide inhibiting compound.
- F. Wire pulling lubricant.
- G. Cable ties.
- H. Firestop sleeves.

**1.2 RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 31 00 - Photovoltaic Collectors: Additional wiring requirements for photovoltaic systems.
- E. Section 28 46 00 - Fire Detection and Alarm: Fire alarm system conductors and cables.
- F. Section 31 23 23 - Fill: Bedding and backfilling.

**1.3 REFERENCE STANDARDS**

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2024).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).
- E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2024.

Low-Voltage Electrical Power Conductors  
and Cables  
26 05 19 - 1

- F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- H. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.
- I. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- L. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- M. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Current Edition, Including All Revisions.
- N. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- O. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- P. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.
- Q. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
  - 3. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- C. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.

- D. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.
- E. Field Quality Control Test Reports.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

#### **1.6 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

#### **1.8 FIELD CONDITIONS**

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify LP Consulting Engineers, Inc. and obtain direction before proceeding with work.

### **PART 2 PRODUCTS**

#### **2.1 CONDUCTOR AND CABLE APPLICATIONS**

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

## **2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS**

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Provide new conductors and cables manufactured not more than one year prior to installation.
- D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- E. Comply with NEMA WC 70.
- F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- H. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.
- I. Conductors and Cables Installed in Cable Tray: Listed and labeled as suitable for cable tray use.
- J. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.
- K. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.
- L. Conductor Material:
  - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
  - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
  - 3. Tinned Copper Conductors: Comply with ASTM B33.
- M. Minimum Conductor Size:
  - 1. Branch Circuits: 12 AWG.
    - a. Exceptions:
      - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
      - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
      - 3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
  - 2. Control Circuits: 14 AWG.



- N. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- O. Conductor Color Coding:
  - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
  - 2. Color Coding Method: Integrally colored insulation.
    - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
  - 3. Color Code:
    - a. 480Y/277 V, 3 Phase, 4 Wire System:
      - 1) Phase A: Brown.
      - 2) Phase B: Orange.
      - 3) Phase C: Yellow.
      - 4) Neutral/Grounded: Gray.
    - b. 208Y/120 V, 3 Phase, 4 Wire System:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
      - 4) Neutral/Grounded: White.
    - c. Equipment Ground, All Systems: Green.
    - d. Isolated Ground, All Systems: Green with yellow stripe.
    - e. Travelers for 3-Way and 4-Way Switching: Pink.
    - f. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
    - g. For control circuits, comply with manufacturer's recommended color code.

## **2.3 SINGLE CONDUCTOR BUILDING WIRE**

- A. Manufacturers:
  - 1. Copper Building Wire:
    - a. Cerro Wire LLC: [www.cerrowire.com/#sle](http://www.cerrowire.com/#sle).
    - b. Encore Wire Corporation: [www.encorewire.com/#sle](http://www.encorewire.com/#sle).
    - c. General Cable Technologies Corporation; \_\_\_\_\_: [www.generalcable.com/#sle](http://www.generalcable.com/#sle).
    - d. Service Wire Co: [www.servicewire.com/#sle](http://www.servicewire.com/#sle).
    - e. Southwire Company: [www.southwire.com/#sle](http://www.southwire.com/#sle).
    - f. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
  - 1. Feeders and Branch Circuits:

- a. Size 10 AWG and Smaller: Solid.
  - b. Size 14 AWG and Larger: Stranded.
- 2. Control Circuits: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
  - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
    - a. Size 4 AWG and Larger: Type XHHW-2.
    - b. Installed Underground: Type XHHW-2.
    - c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

## **2.4 WIRING CONNECTORS**

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.
- C. Wiring Connectors for Splices and Taps:
  - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
  - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- D. Wiring Connectors for Terminations:
  - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
  - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
  - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
  - 4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
  - 5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
  - 6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
  - 7. Conductors for Control Circuits: Use crimped terminals for all connections.

Low-Voltage Electrical Power Conductors  
and Cables

- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
  - 1. Manufacturers:
    - a. 3M: [www.3m.com/#sle](http://www.3m.com/#sle).
    - b. Ideal Industries, Inc: [www.idealindustries.com/#sle](http://www.idealindustries.com/#sle).
    - c. NSI Industries LLC: [www.nsiindustries.com/#sle](http://www.nsiindustries.com/#sle).
    - d. \_\_\_\_\_.
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Mechanical Connectors: Provide bolted type or set-screw type.
  - 1. Manufacturers:
    - a. Burndy LLC; \_\_\_\_\_: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - b. nVent ILSCO: [www.ilsco.com/#sle](http://www.ilsco.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - d. \_\_\_\_\_.
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
  - 1. Manufacturers:
    - a. Burndy LLC; \_\_\_\_\_: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - b. nVent ILSCO: [www.ilsco.com/#sle](http://www.ilsco.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - d. \_\_\_\_\_.
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
  - 1. Manufacturers:
    - a. Burndy LLC; \_\_\_\_\_: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - b. IlSCO: [www.ilsco.com/#sle](http://www.ilsco.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - d. \_\_\_\_\_.
    - e. Substitutions: See Section 01 60 00 - Product Requirements.

## 2.5 ACCESSORIES

- A. Electrical Tape:
  - 1. Manufacturers:
    - a. 3M: [www.3m.com/#sle](http://www.3m.com/#sle).

- b. Plymouth Rubber Europa: [www.plymouthrubber.com/#sle](http://www.plymouthrubber.com/#sle).
  - c. \_\_\_\_\_.
  - d. Substitutions: See Section 01 60 00 - Product Requirements.
- 2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
- 3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
- 4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
- 5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
- 6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
- 7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
  - 1. Manufacturers:
    - a. 3M: [www.3m.com/#sle](http://www.3m.com/#sle).
    - b. Burndy LLC; \_\_\_\_\_: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - d. \_\_\_\_\_.
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
  - 1. Manufacturers:
    - a. Burndy LLC; \_\_\_\_\_: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - b. Ideal Industries, Inc: [www.idealindustries.com/#sle](http://www.idealindustries.com/#sle).
    - c. IlSCO: [www.ilSCO.com/#sle](http://www.ilSCO.com/#sle).
    - d. \_\_\_\_\_.
    - e. Substitutions: See Section 01 60 00 - Product Requirements.

- D. Wire Pulling Lubricant:
  - 1. Manufacturers:
    - a. 3M: [www.3m.com/#sle](http://www.3m.com/#sle).
    - b. American Polywater Corporation: [www.polywater.com/#sle](http://www.polywater.com/#sle).
    - c. Ideal Industries, Inc: [www.idealindustries.com/#sle](http://www.idealindustries.com/#sle).
    - d. \_\_\_\_\_.
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Listed and labeled as complying with UL 267.
  - 3. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
  - 4. Suitable for use at installation temperature.
- E. Cable Ties: Material and tensile strength rating suitable for application.
  - 1. Manufacturers:
    - a. Burndy LLC: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.
  - 1. Products:
    - a. Menzies Metal Products; Electrical Roof Stack and Cap: [www.menzies-metal.com/#sle](http://www.menzies-metal.com/#sle).
    - b. Menzies Metal Products; Electrical Retro Box: [www.menzies-metal.com/#sle](http://www.menzies-metal.com/#sle).
    - c. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
  - 1. Products:
    - a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: [www.holdrite.com/#sle](http://www.holdrite.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

### **3.2 PREPARATION**

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

### **3.3 INSTALLATION**

- A. Circuiting Requirements:
  - 1. Unless dimensioned, circuit routing indicated is diagrammatic.
  - 2. When circuit destination is indicated without specific routing, determine exact routing required.
  - 3. Arrange circuiting to minimize splices.
  - 4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
  - 5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
  - 6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
  - 7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
    - a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
    - b. Increase size of conductors as required to account for ampacity derating.
    - c. Size raceways, boxes, etc. to accommodate conductors.
    - d. \_\_\_\_\_.
  - 8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
  - 9. Provide oversized neutral/grounded conductors where indicated and as specified below.
    - a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
    - b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Installation in Raceway:
  - 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.

2. Pull all conductors and cables together into raceway at same time.
  3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
  4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
  2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- G. Terminate cables using suitable fittings.
- H. Install conductors with a minimum of 12 inches of slack at each outlet.
- I. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.
- J. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- K. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- L. Make wiring connections using specified wiring connectors.
1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
  2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
  3. Do not remove conductor strands to facilitate insertion into connector.
  4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminants. Do not use wire brush on plated connector surfaces.
  5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- M. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
    - a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
    - b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
  2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
    - a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
    - b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
  3. Wet Locations: Use heat shrink tubing.
- N. Insulate ends of spare conductors using vinyl insulating electrical tape.
- O. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- P. Identify conductors and cables in accordance with Section 26 05 53.
- Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- R. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

### **3.4 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
  1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
- D. Correct deficiencies and replace damaged or defective conductors and cables.



**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.
- F. Chemically-enhanced ground electrodes.
- G. Ground plate electrodes.
- H. Ground enhancement material.
- I. Ground access wells.
- J. Pre-fabricated signal reference grids.

**1.2 RELATED REQUIREMENTS**

- A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables:  
Additional requirements for conductors for grounding and bonding, including conductor color coding.
  - 1. Includes oxide inhibiting compound.
- B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- C. Section 26 31 00 - Photovoltaic Collectors: Additional grounding and bonding requirements for photovoltaic systems.
- D. Section 26 56 00 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

**1.3 REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- B. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NFPA 99 - Health Care Facilities Code; 2024, with Errata.
- E. NFPA 780 - Standard for the Installation of Lightning Protection Systems; 2026.
- F. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

Grounding and Bonding for Electrical  
Systems

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Verify exact locations of underground metal water service pipe entrances to building.
  - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
  - 3. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

#### **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
- C. Shop Drawings:
  - 1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Field quality control test reports.
- F. Project Record Documents: Record actual locations of grounding electrode system components and connections.

#### **1.6 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

## **PART 2 PRODUCTS**

### **2.1 GROUNDING AND BONDING REQUIREMENTS**

- A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.
- B. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- E. Grounding System Resistance:
  - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by LP Consulting Engineers, Inc.. Precipitation within the previous 48 hours does not constitute normally dry conditions.
  - 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
  - 3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.
- F. Grounding Electrode System:
  - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
    - a. Provide continuous grounding electrode conductors without splice or joint.
    - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
  - 2. Metal Underground Water Pipe(s):
    - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
    - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.

- c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
- 3. Metal In-Ground Support Structure:
  - a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
- 4. Concrete-Encased Electrode:
  - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
- 5. Ground Ring:
  - a. Provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.
  - b. Where location is not indicated, locate ground ring conductor at least 24 inches outside building perimeter foundation.
  - c. Provide ground enhancement material around conductor where indicated.
  - d. Provide connection from ground ring conductor to:
    - 1) Perimeter columns of metal building frame.
    - 2) Ground rod electrodes located as indicated.
- 6. Ground Rod Electrode(s):
  - a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
  - b. Space electrodes not less than 10 feet from each other and any other ground electrode.
  - c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
  - d. Provide ground enhancement material around electrode where indicated.
  - e. Provide ground access well for each electrode.
- 7. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
- 8. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
  - a. Ground Bar Size: 1/4 by 4 by 12 inches unless otherwise indicated or required.

- b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
  - c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
- 9. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.
- G. Service-Supplied System Grounding:
  - 1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
  - 2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- H. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
  - 1. Provide grounding electrode system for each separate building or structure.
  - 2. Provide equipment grounding conductor routed with supply conductors.
  - 3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
  - 4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.
- I. Separately Derived System Grounding:
  - 1. Separately derived systems include, but are not limited to:
    - a. Transformers (except autotransformers such as buck-boost transformers).
    - b. Uninterruptible power supplies (UPS), when configured as separately derived systems.
  - 2. Provide grounding electrode conductor to connect derived system grounded conductor to common grounding electrode conductor ground riser. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
  - 3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
  - 4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the

- area served by the derived system to the common grounding electrode conductor.
5. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
  6. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
  7. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
- J. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
  2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
  3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
  4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
  5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
  6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
  7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
    - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
    - b. Metal gas piping.
    - c. Metal process piping.
  8. Provide bonding for interior metal air ducts.
  9. Provide bonding for metal building frame.
  10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.

11. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.
  12. Provide redundant grounding and bonding for patient care areas of health care facilities in accordance with NFPA 70 and NFPA 99.
- K. Isolated Ground System:
1. Where isolated ground receptacles or other isolated ground connections are indicated, provide separate isolated/insulated equipment grounding conductors.
  2. Connect isolated/insulated equipment grounding conductors only to separate isolated/insulated equipment ground busses.
  3. Connect the isolated/insulated equipment grounding conductors to the solidly bonded equipment ground bus only at the service disconnect or separately derived system disconnect. Do not make any other connections between isolated ground system and normal equipment ground system on the load side of this connection.
- L. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
  2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
    - a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
    - b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
    - c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
    - d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
- M. Pole-Mounted Luminaires: Also comply with Section 26 56 00.

## **2.2 GROUNDING AND BONDING COMPONENTS**

- A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
  2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:
1. Use insulated copper conductors unless otherwise indicated.
    - a. Exceptions:

- 1) Use bare copper conductors where installed underground in direct contact with earth.
    - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
  2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gauge of specified conductors.
- C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
  2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
    - a. Exceptions:
      - 1) Use mechanical connectors for connections to electrodes at ground access wells.
  3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
    - a. Exceptions:
      - 1) Use exothermic welded connections for connections to metal building frame.
  4. Manufacturers - Mechanical and Compression Connectors:
    - a. allG Fabrication; \_\_\_\_\_: [www.allgfab.com/#sle](http://www.allgfab.com/#sle).
    - b. Burndy LLC; \_\_\_\_\_: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - c. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
    - d. nVent ERICO; \_\_\_\_\_: [www.nvent.com/#sle](http://www.nvent.com/#sle).
    - e. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - f. Substitutions: See Section 01 60 00 - Product Requirements.
  5. Manufacturers - Exothermic Welded Connections:
    - a. Burndy LLC; \_\_\_\_\_: [www.burndy.com/#sle](http://www.burndy.com/#sle).
    - b. nVent ERICO; Cadweld: [www.nvent.com/#sle](http://www.nvent.com/#sle).
    - c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; \_\_\_\_\_: [www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
  2. Size: As indicated.
  3. Holes for Connections: As indicated or as required for connections to be made.
  4. Manufacturers:



- a. allG Fabrication; \_\_\_\_\_: [www.allgfab.com/#sle](http://www.allgfab.com/#sle).
  - b. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
  - c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; \_\_\_\_\_: [www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
  - d. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Ground Rod Electrodes:
  - 1. Comply with NEMA GR 1.
  - 2. Material: Copper-bonded (copper-clad) steel.
  - 3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
  - 4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.
  - 5. Manufacturers:
    - a. allG Fabrication; \_\_\_\_\_: [www.allgfab.com/#sle](http://www.allgfab.com/#sle).
    - b. Galvan Industries, Inc: [www.galvanelectrical.com/#sle](http://www.galvanelectrical.com/#sle).
    - c. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
    - d. nVent ERICO; \_\_\_\_\_: [www.nvent.com/#sle](http://www.nvent.com/#sle).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Chemically-Enhanced Ground Electrodes:
  - 1. Description: Copper tube factory-filled with electrolytic salts designed to provide a low-impedance ground in locations with high soil resistivity; straight (for vertical installations) or L-shaped (for horizontal installations) as indicated or as required.
  - 2. Length: 10 feet.
  - 3. Integral Pigtail: Factory-attached, sized not less than grounding electrode conductor to be attached.
  - 4. Backfill Material: Grounding enhancement material recommended by electrode manufacturer.
  - 5. Manufacturers:
    - a. allG Fabrication; \_\_\_\_\_: [www.allgfab.com/#sle](http://www.allgfab.com/#sle).
    - b. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
    - c. nVent ERICO; \_\_\_\_\_: [www.nvent.com/#sle](http://www.nvent.com/#sle).
    - d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; \_\_\_\_\_: [www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Ground Plate Electrodes:
  - 1. Material: Copper.
  - 2. Size: 24 by 24 by 1/4 inches, unless otherwise indicated.
  - 3. Manufacturers:
    - a. allG Fabrication; \_\_\_\_\_: [www.allgfab.com/#sle](http://www.allgfab.com/#sle).
    - b. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
    - c. nVent ERICO; \_\_\_\_\_: [www.nvent.com/#sle](http://www.nvent.com/#sle).

- d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; \_\_\_\_\_: [www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
  - e. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Ground Enhancement Material:
  - 1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.
  - 2. Manufacturers:
    - a. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
    - b. nVent ERICO; GEM: [www.nvent.com/#sle](http://www.nvent.com/#sle).
    - c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; \_\_\_\_\_: [www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- I. Ground Access Wells:
  - 1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
    - a. Areas Exposed to Vehicular Traffic: Rated for not less than \_\_\_\_\_ pounds vertical design load.
  - 2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
    - a. Round Wells: Not less than 8 inches in diameter.
    - b. Rectangular Wells: Not less than 12 by 12 inches.
  - 3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.
  - 4. Cover: Factory-identified by permanent means with word "GROUND".
  - 5. Manufacturers:
    - a. allG Fabrication; \_\_\_\_\_: [www.allgfab.com/#sle](http://www.allgfab.com/#sle).
    - b. Harger Lightning & Grounding: [www.harger.com/#sle](http://www.harger.com/#sle).
    - c. nVent ERICO; \_\_\_\_\_: [www.nvent.com/#sle](http://www.nvent.com/#sle).
    - d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; \_\_\_\_\_: [www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- J. Oxide Inhibiting Compound: Comply with Section 26 05 19.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

### **3.2 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70.
  - 1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
  - 2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.
- D. Ground Plate Electrodes: Unless otherwise indicated, install ground plate electrodes at a depth of not less than 30 inches.
- E. Make grounding and bonding connections using specified connectors.
  - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
  - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
  - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
  - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- F. Identify grounding and bonding system components in accordance with Section 26 05 53.

### **3.3 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.13.
- D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

- F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

**SECTION 26 05 29**  
**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

**1.2 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 05 50 00 - Metal Fabrications: Materials and requirements for fabricated metal supports.
- C. Section 26 05 33.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- D. Section 26 05 33.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
- E. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- F. Section 26 31 00 - Photovoltaic Collectors: Photovoltaic module mounting systems.
- G. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
- H. Section 26 56 00 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

**1.3 REFERENCE STANDARDS**

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
- D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.
- F. MFMA-4 - Metal Framing Standards Publication; 2004.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Hangers and Supports for Electrical  
Systems

26 05 29 - 1

- I. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
  - 2. Coordinate work to provide additional framing and materials required for installation.
  - 3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
  - 4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
  - 5. Notify LP Consulting Engineers, Inc. of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 03 30 00.

#### **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.
  - 1. Fiberglass Channel/Strut Framing Systems: Include requirements for strength derating according to ambient temperature.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
- D. Derating Calculations for Fiberglass Channel/Strut Framing Systems: Indicate load ratings adjusted for applicable service conditions.
- E. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.
- F. Installer's qualification statement.
- G. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

#### **1.6 QUALITY ASSURANCE**

Hangers and Supports for Electrical  
Systems

- A. Maintain at project site one copy of each referenced document that prescribes execution requirements.
- B. Installer Qualifications for Field Welding: See Section 05 50 00.
- C. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

## **PART 2 PRODUCTS**

### **2.1 SUPPORT AND ATTACHMENT COMPONENTS**

- A. General Requirements:
  - 1. Comply with the following. Where requirements differ, comply with most stringent.
    - a. NFPA 70.
    - b. Applicable building code.
    - c. Requirements of authorities having jurisdiction.
  - 2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
  - 3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
  - 4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 25%. Include consideration for vibration, equipment operation, and shock loads where applicable.
  - 5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
  - 6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
  - 7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
    - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
    - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
    - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

- B. Components for Vibration Isolation and/or Seismic Controls: See Section 26 05 48.
- C. Materials for Metal Fabricated Supports: See Section 05 50 00.
- D. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
  - 1. Manufacturers:
    - a. ABB: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
    - b. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
    - c. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).
    - d. HoldRite, a brand of Reliance Worldwide Corporation: [www.holdrite.com/#sle](http://www.holdrite.com/#sle).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
  - 3. Conduit Clamps: Bolted type unless otherwise indicated.
- E. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
- F. Metal Channel/Strut Framing Systems:
  - 1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
  - 2. Comply with MFMA-4.
  - 3. Channel/Strut Used as Raceway, Where Indicated: Listed and labeled as complying with UL 5B.
  - 4. Channel Material:
    - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
    - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
  - 5. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
  - 6. Minimum Channel Dimensions: 1-5/8 inch width by 1-5/8 inch height.
- G. Fiberglass Channel/Strut Framing Systems:
  - 1. Description: Factory-fabricated, continuous-slot, fiberglass channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
  - 2. Channel Material: Use polyester resin or vinyl ester resin.
  - 3. Minimum Channel Dimensions: 1-5/8 inch wide by 1 inch high.
  - 4. Flammability: Fire retardant with NFPA 101, Class A flame spread index, maximum of 25, when tested in accordance with ASTM E84; self extinguishing in accordance with ASTM D635.
- H. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
  - 1. Minimum Size, Unless Otherwise Indicated or Required:
    - a. Equipment Supports: 1/2-inch diameter.
    - b. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch diameter.

Hangers and Supports for Electrical  
Systems



- c. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.
  - d. Trapeze Support for Multiple Conduits: 3/8-inch diameter.
  - e. Outlet Boxes: 1/4-inch diameter.
  - f. Luminaires: 1/4-inch diameter.
- I. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
  - 1. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
  - 2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
  - 3. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
  - 4. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
- J. Anchors and Fasteners:
  - 1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
  - 2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
  - 3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
  - 4. Hollow Masonry: Use toggle bolts.
  - 5. Hollow Stud Walls: Use toggle bolts.
  - 6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
  - 7. Sheet Metal: Use sheet metal screws.
  - 8. Wood: Use wood screws.
  - 9. Hammer-driven anchors and fasteners are not permitted.
  - 10. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    - a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
    - b. Comply with MFMA-4.
    - c. Channel Material: Use galvanized steel.
    - d. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
  - 11. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.

Hangers and Supports for Electrical  
Systems

- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

### **3.2 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install hangers and supports in accordance with NECA 1.
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- E. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from suspended ceiling support system or ceiling grid.
- F. Unless specifically indicated or approved by LP Consulting Engineers, Inc., do not provide support from roof deck.
- G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- H. Provide required vibration isolation and/or seismic controls; see Section 26 05 48.
- I. Field Welding, Where Approved by LP Consulting Engineers, Inc.: See Section 05 50 00.
- J. Equipment Support and Attachment:
  - 1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
  - 2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  - 3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
  - 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized concrete pad 3 inches in height; see Section 03 30 00.
  - 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- K. Conduit Support and Attachment: See Section 26 05 33.13 for additional requirements.
- L. Box Support and Attachment: See Section 26 05 33.16 for additional requirements.
- M. Interior Luminaire Support and Attachment: See Section 26 51 00 for additional requirements.

- N. Exterior Luminaire Support and Attachment: See Section 26 56 00 for additional requirements.
- O. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- P. Secure fasteners in accordance with manufacturer's recommended torque settings.
- Q. Remove temporary supports.
- R. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

### **3.3 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.

**SECTION 26 05 33.13  
CONDUIT FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Galvanized steel rigid metal conduit (RMC).
- B. Galvanized steel intermediate metal conduit (IMC).
- C. PVC-coated galvanized steel rigid metal conduit (RMC).
- D. Flexible metal conduit (FMC).
- E. Liquidtight flexible metal conduit (LFMC).
- F. Galvanized steel electrical metallic tubing (EMT).
- G. Rigid polyvinyl chloride (PVC) conduit.

**1.2 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete encasement of conduits.
- B. Section 07 84 00 - Firestopping.
- C. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Cable assemblies consisting of conductors protected by integral metal armor.
- D. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
  - 1. Includes additional requirements for fittings for grounding and bonding.
- E. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- F. Section 26 05 33.16 - Boxes for Electrical Systems.
- G. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- H. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- I. Section 26 21 00 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.
- J. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

**1.3 REFERENCE STANDARDS**

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
- C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.

- F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2025.
- G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.
- I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.
- J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.
- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- M. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- N. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.
- O. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.
- P. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- Q. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- R. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- S. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.
- T. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.
- U. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
  - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
  - 4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.

5. Notify LP Consulting Engineers, Inc. of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
  1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

## **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- C. Shop Drawings:
  1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
  2. Include proposed locations of roof penetrations and proposed methods for sealing.
- D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

## **1.6 QUALITY ASSURANCE**

- A. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions and shop drawings.
- B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

# **PART 2 PRODUCTS**

## **2.1 CONDUIT APPLICATIONS**

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
  1. Under Slab on Grade: Use PVC-coated galvanized steel rigid metal conduit (RMC) or rigid PVC conduit.
  2. Exterior, Direct-Buried: Use PVC-coated galvanized steel rigid metal conduit or rigid PVC conduit.

3. Exterior, Embedded Within Concrete: Use PVC-coated galvanized steel rigid metal conduit (RMC) or rigid PVC conduit.
  4. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to PVC-coated galvanized steel rigid metal conduit (RMC) where emerging from underground.
  5. Where rigid polyvinyl (PVC) conduit larger than 2-inch (53 mm) trade size is provided, use PVC-coated galvanized steel rigid metal conduit (RMC) elbows or concrete-encased PVC elbows for bends.
  6. Where galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC) is installed in direct contact with earth where soil has resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.
- D. Embedded Within Concrete:
1. Within Slab on Grade: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC). Embed within structural slabs only where approved by Structural Engineer.
  2. Within Slab Above Ground: Use PVC-coated galvanized steel rigid metal conduit (RMC) or rigid PVC conduit. Embed within structural slabs only where approved by Structural Engineer.
  3. Within Concrete Walls Above Ground: Use PVC-coated galvanized steel rigid metal conduit (RMC) or rigid PVC conduit.
  4. Where rigid polyvinyl (PVC) conduit is provided, transition to PVC-coated galvanized steel rigid metal conduit (RMC) where emerging from concrete.
- E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit (RMC).
- F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).
- G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).
- H. Interior, Damp or Wet Locations: Use PVC-coated galvanized steel rigid metal conduit (RMC).

- I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).
- J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC).
  - 1. Locations subject to physical damage include, but are not limited to:
    - a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
    - b. Where exposed below 20 feet in warehouse areas.
- K. Exposed, Interior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC).
  - 1. Locations subject to severe physical damage include, but are not limited to:
    - a. High traffic industrial and warehouse areas where exposed below 8 feet, except within electrical and communication rooms or closets.
    - b. Where exposed below 20 feet in industrial manufacturing areas.
- L. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).
- M. Exposed, Exterior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC).
  - 1. Exterior locations subject to severe physical damage include, but are not limited to:
    - a. Where exposed to vehicular traffic below 20 feet.
- N. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).
- O. Corrosive Locations Above Ground: Use stainless steel rigid metal conduit (RMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), or stainless steel electrical metallic tubing (EMT).
  - 1. Corrosive locations include, but are not limited to:
    - a. Cooling towers.
    - b. Electroplating operations.
    - c. Swimming pools and associated equipment areas.
    - d. Wastewater treatment facilities.
    - e. Marine environments.
    - f. Chemical storage areas.
- P. Hazardous/Classified Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit (RMC).



- Q. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
  - 1. Maximum Length: 6 feet.
- R. Flexible Connections to Vibrating Equipment:
  - 1. Dry Locations: Use flexible metal conduit (FMC).
  - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
  - 3. Maximum Length: 6 feet unless otherwise indicated.
  - 4. Vibrating equipment includes, but is not limited to:
    - a. Transformers.
    - b. Motors.
- S. Fished in Existing Walls, Where Necessary: Use flexible metal conduit (FMC) or galvanized steel electrical metallic tubing (EMT).

## **2.2 CONDUIT - GENERAL REQUIREMENTS**

- A. Comply with NFPA 70.
- B. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.
  - 1. Where permitted, existing conduits to be reused may be used as sole equipment grounding conductor only when continuity of conduit pathway, including associated boxes and fittings, is verified; see Section 26 05 26.
- C. Electrical Service Conduits: See Section 26 21 00 for additional requirements.
- D. Fittings for Grounding and Bonding: See Section 26 05 26 for additional requirements.
- E. Provide conduit, fittings, supports, and accessories required for complete raceway system.
- F. Provide products listed, classified, and labeled as suitable for purpose intended.
- G. Minimum Conduit Size, Unless Otherwise Indicated:
  - 1. Branch Circuits: 1/2-inch trade size.
  - 2. Branch Circuit Homeruns: 3/4-inch trade size.
  - 3. Control Circuits: 1/2-inch trade size.
  - 4. Flexible Connections to Luminaires: 3/8-inch trade size.
  - 5. Underground, Interior: 1-inch trade size.
  - 6. Underground, Exterior: 1-inch trade size.
- H. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

## **2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)**

- A. Manufacturers:
  - 1. Allied Tube & Conduit, a division of Atkore International:  
[www.alliedeg.com/#sle](http://www.alliedeg.com/#sle).

2. Nucor Tubular Products: [www.nucortubular.com/#sle](http://www.nucortubular.com/#sle).
  3. Rymco USA: [www.rymcousa.com/#sle](http://www.rymcousa.com/#sle).
  4. Western Tube, a division of Zekelman Industries: [www.westerntube.com/#sle](http://www.westerntube.com/#sle).
  5. Wheatland Tube, a division of Zekelman Industries: [www.wheatland.com/#sle](http://www.wheatland.com/#sle).
  6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Factory-Painted, Color-Coded Galvanized Steel RMC: Apply according to indicated color code.
1. See Section 26 05 53 for color code.
- D. Fittings:
1. Manufacturers:
    - a. ABB; T&B: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
    - b. Allied Tube & Conduit, a division of Atkore International: [www.alliedeg.us/#sle](http://www.alliedeg.us/#sle).
    - c. Bridgeport Fittings Inc: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
    - d. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
  2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
  3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
  4. Material: Use steel or malleable iron.
    - a. Where not subject to severe corrosive influence, stainless steel fittings may be used.
    - b. Do not use die cast zinc fittings.
  5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

## **2.4 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)**

- A. Manufacturers:
1. Allied Tube & Conduit, a division of Atkore International: [www.alliedeg.com/#sle](http://www.alliedeg.com/#sle).
  2. Nucor Tubular Products: [www.nucortubular.com/#sle](http://www.nucortubular.com/#sle).
  3. Rymco USA: [www.rymcousa.com/#sle](http://www.rymcousa.com/#sle).
  4. Western Tube, a division of Zekelman Industries: [www.westerntube.com/#sle](http://www.westerntube.com/#sle).
  5. Wheatland Tube, a division of Zekelman Industries: [www.wheatland.com/#sle](http://www.wheatland.com/#sle).
  6. Substitutions: See Section 01 60 00 - Product Requirements.

- B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- C. Fittings:
  - 1. Manufacturers:
    - a. ABB; T&B: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
    - b. Allied Tube & Conduit, a division of Atkore International: [www.alliedeg.us/#sle](http://www.alliedeg.us/#sle).
    - c. Bridgeport Fittings, LLC: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
    - d. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
  - 3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
  - 4. Material: Use steel or malleable iron.
  - 5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

## **2.5 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)**

- A. Manufacturers:
  - 1. ABB; Ocal: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
  - 2. Calbond, a division of Atkore International [www.calbond.com/#sle](http://www.calbond.com/#sle)
  - 3. Robroy Industries: [www.robroy.com/#sle](http://www.robroy.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch.
- D. Interior Coating: Urethane, minimum thickness of 2 mil, 0.002 inch.
- E. PVC-Coated Boxes and Fittings:
  - 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
  - 2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
  - 3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
  - 4. Material: Use steel or malleable iron.
  - 5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch.
  - 6. Interior Coating: Urethane, minimum thickness of 2 mil, 0.002 inch.

- F. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch.

## **2.6 FLEXIBLE METAL CONDUIT (FMC)**

- A. Manufacturers:
  - 1. AFC Cable Systems, a division of Atkore International: [www.afcweb.com/#sle](http://www.afcweb.com/#sle).
  - 2. Electri-Flex Company: [www.electriflex.com/#sle](http://www.electriflex.com/#sle).
  - 3. International Metal Hose: [www.metalhose.com/#sle](http://www.metalhose.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.
- C. Fittings:
  - 1. Manufacturers:
    - a. ABB; T&B: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
    - b. Bridgeport Fittings, LLC: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
    - c. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 3. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.

## **2.7 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)**

- A. Manufacturers:
  - 1. AFC Cable Systems, a division of Atkore International: [www.afcweb.com/#sle](http://www.afcweb.com/#sle).
  - 2. Electri-Flex Company: [www.electriflex.com/#sle](http://www.electriflex.com/#sle).
  - 3. International Metal Hose: [www.metalhose.com/#sle](http://www.metalhose.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
  - 1. Manufacturers:
    - a. ABB; T&B: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
    - b. Bridgeport Fittings, LLC: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
    - c. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 3. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.

## **2.8 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)**

- A. Manufacturers:
  - 1. Allied Tube & Conduit, a division of Atkore International: [www.alliedeg.com/#sle](http://www.alliedeg.com/#sle).
  - 2. Nucor Tubular Products: [www.nucortubular/#sle](http://www.nucortubular/#sle).
  - 3. Rymco USA: [www.rymcousa.com/#sle](http://www.rymcousa.com/#sle).
  - 4. Western Tube, a division of Zekelman Industries: [www.westerntube.com/#sle](http://www.westerntube.com/#sle).
  - 5. Wheatland Tube, a division of Zekelman Industries: [www.wheatland.com/#sle](http://www.wheatland.com/#sle).
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Factory-Painted, Color-Coded Galvanized Steel EMT: Apply according to indicated color code.
  - 1. See Section 26 05 53 for color code.
  - 2. Products:
    - a. Rymco USA; Real Color: [www.rymcousa.com/#sle](http://www.rymcousa.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Fittings:
  - 1. Manufacturers:
    - a. ABB; T&B: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
    - b. Allied Tube & Conduit, a division of Atkore International: [www.alliedeg.us/#sle](http://www.alliedeg.us/#sle).
    - c. Bridgeport Fittings, LLC: [www.bptfittings.com/#sle](http://www.bptfittings.com/#sle).
    - d. Emerson Electric Co; O-Z/Gedney: [www.emerson.com/#sle](http://www.emerson.com/#sle).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 3. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.
  - 4. Connectors and Couplings: Use compression/gland type.
    - a. Do not use indenter type connectors and couplings.
    - b. Do not use set-screw type connectors and couplings.
  - 5. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.
  - 6. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

## **2.9 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT**

- A. Manufacturers:
  - 1. ABB; Carlon: [www.carlon.com/#sle](http://www.carlon.com/#sle).

2. Allied Tube & Conduit, a division of Atkore International:  
www.alliedeg.com/#sle.
  3. Cantex Inc: www.cantexinc.com/#sle.
  4. Heritage Plastics, a division of Atkore International:  
www.heritageplastics.com/#sle.
  5. JM Eagle: www.jmeagle.com/#sle.
  6. Rymco USA: www.rymcousa.com/#sle.
  7. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
  2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

## **2.10 ACCESSORIES**

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.
- E. Foam Conduit Sealant:
1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.
  2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
  3. Rated to hold minimum of 10 ft water head pressure.
  4. Products:
    - a. American Polywater Corporation; Polywater AFT Foam Duct Sealant: www.polywater.com/#sle.
    - b. American Polywater Corporation; Polywater FST Foam Duct Sealant: www.polywater.com/#sle.
    - c. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Conduit Mechanical Seals:
1. Listed as complying with UL 514B.
  2. Specifically designed for sealing conduit openings against water, moisture, gases, and dust.

3. Suitable for sealing around conductors/cables to be installed.
4. Products:
  - a. American Polywater Corporation; PHRD SG Mechanical Seals: [www.polywater-haufftechnik.com/#sle](http://www.polywater-haufftechnik.com/#sle).
  - b. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Sealing Compound for Hazardous/Classified Location Sealing Fittings: Listed for use with particular fittings to be installed.
- H. Sealing Systems for Concrete Penetrations:
  1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
  2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.
  3. Products:
    - a. American Polywater Corporation; PZVR Cement-Coated Concrete Wall Sleeves: [www.polywater-haufftechnik.com/#sle](http://www.polywater-haufftechnik.com/#sle).
    - b. American Polywater Corporation; PHSD Mechanical Seals: [www.polywater-haufftechnik.com/#sle](http://www.polywater-haufftechnik.com/#sle).
    - c. American Polywater Corporation; PHSI 150 Varia Double Wall Inserts: [www.polywater-haufftechnik.com/#sle](http://www.polywater-haufftechnik.com/#sle).
    - d. American Polywater Corporation; PGKD Modular Seals: [www.polywater-haufftechnik.com/#sle](http://www.polywater-haufftechnik.com/#sle).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- I. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
  1. Products:
    - a. Alta Products, LLC; Sigrist Pipe Chase Housing, Curbs, and Exit Seals: [www.altaproductsllc.com/#sle](http://www.altaproductsllc.com/#sle).
    - b. Menzies Metal Products; Electrical Roof Stack and Cap: [www.menzies-metal.com/#sle](http://www.menzies-metal.com/#sle).
    - c. Menzies Metal Products; Electrical Retro Box: [www.menzies-metal.com/#sle](http://www.menzies-metal.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- J. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
  1. Products:
    - a. Quickflash Weatherproofing Products, Inc: [www.quickflashproducts.com/#sle](http://www.quickflashproducts.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- K. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

1. Products:
  - a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: [www.holdrite.com/#sle](http://www.holdrite.com/#sle).
  - b. Substitutions: See Section 01 60 00 - Product Requirements.
- L. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.
  1. Products:
    - a. Advance Products & Systems, LLC; Duct Bank Spacers: [www.apsonline.com/#sle](http://www.apsonline.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- M. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for casing and conduit/duct arrangement to be installed.
  1. Products:
    - a. Advance Products & Systems, LLC; Bore Spacers: [www.apsonline.com/#sle](http://www.apsonline.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

### **3.2 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1.
- C. Galvanized Steel Rigid Metal Conduit (RMC): Install in accordance with NECA 101.
- D. Intermediate Metal Conduit (IMC): Install in accordance with NECA 101.
- E. PVC-Coated Galvanized Steel Rigid Metal Conduit (RMC): Install using only tools approved by manufacturer.
- F. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.
- G. Conduit Routing:
  1. Unless dimensioned, conduit routing indicated is diagrammatic.
  2. When conduit destination is indicated without specific routing, determine exact routing required.
  3. Conceal conduits unless specifically indicated to be exposed.
  4. Conduits in the following areas may be exposed, unless otherwise indicated:



- a. Electrical rooms.
  - b. Mechanical equipment rooms.
  - c. Within joists in areas with no ceiling.
- 5. Unless otherwise approved, do not route exposed conduits:
  - a. Across floors.
  - b. Across roofs.
  - c. Across top of parapet walls.
  - d. Across building exterior surfaces.
- 6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
- 7. Arrange conduit to maintain adequate headroom, clearances, and access.
- 8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
- 9. Arrange conduit to provide no more than 150 feet between pull points.
- 10. Route conduits above water and drain piping where possible.
- 11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
- 12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
- 13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
  - a. Heaters.
  - b. Hot water piping.
  - c. Flues.
- 14. Group parallel conduits in same area on common rack.
- H. Conduit Support:
  - 1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 05 29.
  - 2. Provide required vibration isolation and/or seismic controls; see Section 26 05 48.
  - 3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
  - 4. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
  - 5. Use conduit strap to support single surface-mounted conduit.
    - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
  - 6. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.

7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
  8. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
  9. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
  10. Use of spring steel conduit clips for support of conduits is not permitted.
  11. Use of wire for support of conduits is not permitted.
  12. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.
- I. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
  2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
  3. Use suitable adapters where required to transition from one type of conduit to another.
  4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
  5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
  6. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
  7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
  8. Secure joints and connections to provide mechanical strength and electrical continuity.
- J. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
  2. Make penetrations perpendicular to surfaces unless otherwise indicated.
  3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
  4. Conceal bends for conduit risers emerging above ground.
  5. Provide suitable sealing system where conduits penetrate exterior wall below grade.
  6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
  7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing

- system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
8. Provide metal escutcheon plates for conduit penetrations exposed to public view.
  9. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 84 00.
- K. Underground Installation:
1. Provide trenching and backfilling; see Section 31 23 16.13.
  2. Minimum Cover, Unless Otherwise Indicated or Required:
    - a. Underground, Exterior: 24 inches.
    - b. Under Slab on Grade: 12 inches to bottom of slab.
  3. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 26 05 53.
- L. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Maximum Conduit Size: 1-inch trade size unless otherwise approved.
  2. Install conduits within middle one third of slab thickness.
  3. Secure conduits to prevent floating or movement during pouring of concrete.
- M. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches on all sides unless otherwise indicated; see Section 03 30 00.
- N. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
  2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
  3. Where conduits are subject to earth movement by settlement or frost.
- O. Conduit Sealing:
1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
    - a. Where conduits enter building from outside.
    - b. Where service conduits enter building from underground distribution system.
    - c. Where conduits enter building from underground.
    - d. Where conduits may transport moisture to contact live parts.
  2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point

near penetration to prevent condensation. This includes, but is not limited to:

- a. Where conduits pass from outdoors into conditioned interior spaces.
  - b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
  - c. Where conduits penetrate coolers or freezers.
3. Where conduits cross boundaries of hazardous/classified locations, provide identified/listed sealing fittings or conduit mechanical seals as approved by authorities having jurisdiction; locate as indicated or in accordance with NFPA 70.
- P. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
  - Q. Provide grounding and bonding; see Section 26 05 26.
  - R. Identify conduits; see Section 26 05 53.

### **3.3 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- D. Correct deficiencies and replace damaged or defective conduits.

### **3.4 CLEANING**

- A. Clean interior of conduits to remove moisture and foreign matter.

### **3.5 PROTECTION**

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

**SECTION 26 05 33.16**  
**BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.
  - 1. Boxes and enclosures for integrated power, data, and audio/video.
  - 2. Boxes for hazardous (classified) locations.
  - 3. Floor boxes.
  - 4. Underground boxes/enclosures.
  - 5. Accessories.

**1.2 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 07 84 00 - Firestopping.
- C. Section 08 31 00 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- D. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- E. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- F. Section 26 05 33.13 - Conduit for Electrical Systems:
  - 1. Conduit bodies and other fittings.
  - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- G. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- H. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- I. Section 26 27 26 - Wiring Devices:
  - 1. Wall plates.
  - 2. Floor box service fittings.
  - 3. Additional requirements for locating boxes for wiring devices.
- J. Section 26 28 13 - Fuses: Spare fuse cabinets.

**1.3 REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
- C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

- D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. SCTE 77 - Specifications for Underground Enclosure Integrity; 2023.
- H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.
- K. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.
- L. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
  - 4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
  - 5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
  - 6. Coordinate the work with other trades to preserve insulation integrity.
  - 7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
  - 8. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.
- C. Samples:
  1. Floor Boxes: Provide one sample(s) of each floor box proposed for substitution upon request.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Keys for Lockable Enclosures: Two of each different key.

## **1.6 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

# **PART 2 PRODUCTS**

## **2.1 BOXES**

- A. General Requirements:
  1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
  2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
  3. Provide products listed, classified, and labeled as suitable for the purpose intended.
  4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
  5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

- B. Outlet and Device Boxes Up to 126 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
  2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
  3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
  4. Use cast aluminum boxes where aluminum rigid metal conduit is used.
  5. Use suitable concrete type boxes where flush-mounted in concrete.
  6. Use suitable masonry type boxes where flush-mounted in masonry walls.
  7. Use raised covers suitable for the type of wall construction and device configuration where required.
  8. Use shallow boxes where required by the type of wall construction.
  9. Do not use "through-wall" boxes designed for access from both sides of wall.
  10. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
  11. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
  12. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
  13. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
  14. Minimum Box Size, Unless Otherwise Indicated:
    - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
    - b. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
  15. Wall Plates: Comply with Section 26 27 26.
  16. Manufacturers:
    - a. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
    - b. Hubbell Incorporated; Bell Products; \_\_\_\_\_: [www.hubbell-rtb.com/#sle](http://www.hubbell-rtb.com/#sle).
    - c. Hubbell Incorporated; RACO Products; \_\_\_\_\_: [www.hubbell-rtb.com/#sle](http://www.hubbell-rtb.com/#sle).
    - d. O-Z/Gedney, a brand of Emerson Electric Co; \_\_\_\_\_: [www.emerson.com/#sle](http://www.emerson.com/#sle).
    - e. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).



- f. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
  - 1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
  - 2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
    - a. Indoor Clean, Dry Locations: Type 1, painted steel.
    - b. Outdoor Locations: Type 3R, painted steel.
  - 3. Junction and Pull Boxes Larger Than 100 cubic inches:
    - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
    - b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
  - 4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    - a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
    - b. Back Panels: Painted steel, removable.
    - c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
  - 5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
  - 6. Manufacturers:
    - a. Cooper B-Line, a division of Eaton Corporation: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
    - b. Hoffman, a brand of Pentair Technical Products: [www.hoffmanonline.com/#sle](http://www.hoffmanonline.com/#sle).
    - c. Hubbell Incorporated; Wiegmann Products: [www.hubbell-wiegmann.com/#sle](http://www.hubbell-wiegmann.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.
  - 1. Manufacturers:
    - a. Hubbell Incorporated: [www.hubbell.com/#sle](http://www.hubbell.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.
  - 1. Manufacturers:
    - a. Appleton, a brand of Emerson Electric Co; \_\_\_\_\_: [www.emerson.com/#sle](http://www.emerson.com/#sle).

- b. Cooper Crouse-Hinds, a division of Eaton Corporation:  
www.cooperindustries.com/#sle.
  - c. Hubbell Incorporated; Killark Products: www.hubbell-killark.com/#sle.
  - d. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Floor Boxes:
  - 1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 27 26; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
  - 2. Use cast iron floor boxes within slab on grade.
  - 3. Use sheet-steel or cast iron floor boxes within slab above grade.
  - 4. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
  - 5. Manufacturer:
- G. Underground Boxes/Enclosures:
  - 1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
  - 2. Size: As indicated on drawings.
  - 3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
  - 4. Provide logo on cover to indicate type of service.
  - 5. Applications:
    - a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
    - b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.
    - c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
  - 6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
    - a. Manufacturers:
      - 1) Hubbell Incorporated; Quazite Products:  
www.hubbellpowersystems.com/#sle.
      - 2) MacLean Highline; \_\_\_\_\_:  
www.macleanhighline.com/#sle.
      - 3) Oldcastle Precast, Inc: www.oldcastleprecast.com/#sle.
      - 4) Substitutions: See Section 01 60 00 - Product Requirements.
    - b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.
    - c. Product(s):

- 1) MacLean Highline PHA Series: Straight wall, all-polymer concrete splice box/pull box; available Tier 8, Tier 15, and Tier 22 load ratings.
  - (a) 11 by 18 by 12 inches nominal; Model PHA111812 (stackable).
- 2) MacLean Highline CHA Series: Fiberglass/polymer concrete splice box/pull box; available Tier 8 and Tier 15 load ratings.
  - (a) 11 by 18 by 12 inches nominal; Model CHA111812.
- 3) MacLean Highline CVA Series: Fiberglass/polymer concrete splice vault; available Tier 8, Tier 15, and Tier 22 load ratings.
  - (a) 30 by 48 by 18 inches nominal; Model CVA304818.

## **2.2 ACCESSORIES**

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.
  1. Manufacturers:
    - a. Quickflash Weatherproofing Products, Inc:  
[www.quickflashproducts.com/#sle](http://www.quickflashproducts.com/#sle).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Boxes are indicated in approximate locations only on the drawings unless specifically dimensioned. Verify all box locations prior to rough-in.
- C. Verify that mounting surfaces are ready to receive boxes.
- D. Verify that conditions are satisfactory for installation prior to starting work.
- E. Verify locations of floor boxes and outlets prior to rough-in.
- F. Verify locations of all boxes required for kitchen equipment with kitchen consultant plans and specifications.

### **3.2 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. Box Locations:
  - 1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required where approved by the Architect.
  - 2. Unless dimensioned, box locations indicated are approximate.
  - 3. Locate boxes as required for devices installed under other sections or by others.
    - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 27 26.
    - b. Communications Systems Outlets: Comply with Section 27 10 00.
  - 4. Locate boxes so that wall plates do not span different building finishes.
  - 5. Locate boxes so that wall plates do not cross masonry joints.
  - 6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
  - 7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
  - 8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
  - 9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
    - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
    - b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
  - 10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 33.13.
  - 11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    - a. Concealed above accessible suspended ceilings.
    - b. Within joists in areas with no ceiling.
    - c. Electrical rooms.
    - d. Mechanical equipment rooms.
- I. Box Supports:

1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
  2. Provide required seismic controls in accordance with Section 26 05 48.
  3. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
  4. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
  5. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.
- J. Install boxes plumb and level.
- K. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
  2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
  3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- L. Floor-Mounted Cabinets: Mount on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.
- M. Install boxes as required to preserve insulation integrity.
- N. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.
- O. Underground Boxes/Enclosures:
1. Install enclosure on gravel base, minimum 6 inches deep.
  2. Flush-mount enclosures located in concrete or paved areas.
  3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
  4. Provide cast-in-place concrete collar constructed in accordance with Section 03 30 00, minimum 10 inches wide by 12 inches deep, around enclosures that are not located in concrete areas.
  5. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.
- P. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

- Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- R. Close unused box openings.
- S. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- T. Provide grounding and bonding in accordance with Section 26 05 26.
- U. Identify boxes in accordance with Section 26 05 53.

### **3.3 CLEANING**

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

### **3.4 PROTECTION**

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

**SECTION 26 05 48**  
**VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Vibration isolation requirements.
- B. Seismic control requirements.
  - 1. Includes requirements for seismic qualification of equipment not specified in this section.
- C. Vibration-isolated equipment support bases.
- D. Vibration isolators.
- E. External seismic snubber assemblies.
- F. Seismic restraint systems.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 45 33 - Code-Required Special Inspections and Procedures.
- B. Section 03 30 00 - Cast-in-Place Concrete.
- C. Section 05 50 00 - Metal Fabrications: Materials and requirements for fabricated metal supports.
- D. Section 26 05 29 - Hangers and Supports for Electrical Systems.

**1.3 DEFINITIONS**

- A. Electrical Component: Where referenced in this section in regards to seismic controls, applies to any portion of the electrical system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., conduit, cable tray).
- B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

**1.4 REFERENCE STANDARDS**

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016.
- C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2024a.

Vibration and Seismic Controls for Electrical  
Systems

- E. FEMA 413 - Installing Seismic Restraints for Electrical Equipment; 2004.
- F. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage; 2012.
- G. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components; 2010, with Editorial Revision (2020).
- I. MFMA-4 - Metal Framing Standards Publication; 2004.
- J. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2024.

## **1.5 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
  - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
  - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
  - 4. Seismic Controls:
    - a. Coordinate the arrangement of seismic restraints with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
    - b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
  - 5. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

## **1.6 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.



- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
  - 1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
  - 2. Seismic Controls: Include seismic load capacities.
- D. Shop Drawings - Vibration Isolation Systems:
  - 1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
  - 2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.
- E. Shop Drawings - Seismic Controls:
  - 1. Include dimensioned plan views and sections indicating proposed electrical component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
  - 2. Identify mounting conditions required for equipment seismic qualification.
  - 3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
  - 4. Indicate proposed arrangement of distributed system trapeze support groupings.
  - 5. Indicate proposed locations for distributed system flexible fittings and/or connections.
  - 6. Indicate locations of seismic separations where applicable.
  - 7. Include point load drawings indicating design loads transmitted to structure at each attachment location.
- F. Seismic Design Data:
  - 1. Compile information on project-specific characteristics of actual installed electrical components necessary for determining seismic design forces required to design appropriate seismic controls, including but not limited to the following.
  - 2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.
- G. Certification for seismically qualified equipment; identify basis for certification.
- H. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.

- I. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- J. Evidence of qualifications for seismic controls designer.
- K. Evidence of qualifications for manufacturer.
- L. Manufacturer's detailed field testing and inspection procedures.
- M. Field quality control test reports.

#### **1.7 QUALITY ASSURANCE**

- A. Comply with NFPA 70.
- B. Comply with applicable building code.
- C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- D. Seismic Controls Designer Qualifications: Registered professional engineer licensed in California and with minimum five years experience designing seismic restraints for nonstructural components.
  - 1. Designer may be employed by the manufacturer of the seismic restraint products.
- E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

#### **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

### **PART 2 PRODUCTS**

#### **2.1 VIBRATION ISOLATION REQUIREMENTS**

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing electrical equipment and/or electrical connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
  - 1. Select vibration isolators to provide required static deflection.
  - 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
  - 3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.

4. Select vibration isolators for outdoor equipment to comply with wind design requirements.
  5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.
- D. Equipment Isolation:
1. Transformers:
    - a. Specified vibration isolators are in addition to any factory-installed internal core and coil assembly vibration isolators unless otherwise indicated.
    - b. Floor-Mounted Transformers, Nonseismic Applications: Use resilient material isolator pads, resilient material isolator mounts, or open (unhoused) spring isolators.
    - c. Floor-Mounted Transformers, Seismic Applications: Use seismic type resilient material isolator mounts or seismic type restrained spring isolators.
    - d. Suspended Transformers, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
    - e. Suspended Transformers, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
    - f. Wall-Mounted Transformers, Nonseismic Applications: Use resilient material isolator mounts.
    - g. Wall-Mounted Transformers, Seismic Applications: Use seismic type resilient material isolator mounts.
    - h. Minimum Static Deflection:
      - 1) Transformers Mounted on Grade-Level Slabs: 0.25 inch deflection unless otherwise indicated.
      - 2) Transformers Mounted at Above-Grade Levels: 0.5 inch deflection unless otherwise indicated.
- E. Conduit Isolation:
1. Use flexible conduit or cable for electrical connections to vibration-isolated equipment, including equipment installed under other sections or by others.
    - a. Minimum Length: 3 feet unless otherwise indicated.
  2. Vibration Isolators:
    - a. Provide vibration isolators for conduit supports:
      - 1) Located within 50 feet of connected vibration-isolated equipment where flexible connection to equipment is not possible.

- 2) For conduits over 2 inch trade size located below or within 50 feet of noise-sensitive areas indicated.
- b. Minimum Static Deflection:
  - 1) First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch deflection required.
  - 2) Remainder of Supports: 0.75 inch deflection unless otherwise indicated.
- c. Suspended Conduits, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
- d. Suspended Conduits, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
- e. Use modular seal or approved resilient material where vibration-isolated conduits penetrate building elements (e.g., walls, floors) arranged to prevent vibration transmission to structure.

## **2.2 SEISMIC CONTROL REQUIREMENTS**

- A. Design and provide electrical component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor electrical components.
- B. Seismic Design Criteria: ICC (IBC).
- C. Component Importance Factor (Ip): Electrical components to be assigned a component importance factor (Ip) of 1.5 unless otherwise indicated.
- D. Seismic Qualification of Equipment:
  1. Provide special certification for electrical equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.
  2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
  3. Notify LP Consulting Engineers, Inc. and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
  4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.
- E. Seismic Restraints:

1. Provide seismic restraints for electrical components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
2. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
  - a. ASHRAE (HVACA).
  - b. FEMA 413.
  - c. FEMA E-74.
  - d. SMACNA (SRM).
3. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
4. Seismic Type Vibration Isolators:
  - a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
5. External Seismic Snubber Assemblies:
  - a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).
  - b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.
6. Seismic Restraint Systems:
  - a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
  - b. Use only cable restraints to restrain vibration-isolated electrical components, including distributed systems.
  - c. Use only one restraint system type for a given electrical component or distributed system (e.g., conduit, cable tray) run; mixing of cable and rigid restraints on a given component/run is not permitted.
  - d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain electrical component in all lateral directions; consider bracket geometry in anchor load calculations.
  - e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported electrical component weight.
  - f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid

restraints loaded in compression, in addition to downward tensile load due to supported electrical component weight.

- g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
- h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
- i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.
- j. Manufacturer's certified seismic restraint design may be submitted as an alternative to project-specific design and documentation, subject to approval of authorities having jurisdiction.

F. Seismic Attachments:

- 1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
- 2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
- 3. Do not use power-actuated fasteners.
- 4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.
- 5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
- 6. Concrete Housekeeping Pads:
  - a. Increase size of pad as required to comply with anchor requirements.
  - b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

G. Seismic Interactions:

- 1. Include provisions to prevent seismic impact between electrical components and other structural or nonstructural components.
- 2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.

H. Seismic Relative Displacement Provisions:

- 1. Use suitable fittings or flexible connections to accommodate:

- a. Relative displacements at connections between components, including distributed systems (e.g., conduit, cable tray); do not exceed load limits for equipment utility connections.
- b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
- c. Design displacements at seismic separations.
- d. Anticipated drifts between floors.

## **2.3 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES**

### **A. Manufacturers:**

- 1. Vibration-Isolated Equipment Support Bases:
    - a. Kinetics Noise Control, Inc; \_\_\_\_\_: [www.kineticsnoise.com/#sle](http://www.kineticsnoise.com/#sle).
    - b. Mason Industries; \_\_\_\_\_: [www.mason-ind.com/#sle](http://www.mason-ind.com/#sle).
    - c. Vibration Eliminator Company, Inc; \_\_\_\_\_: [www.veco-nyc.com/#sle](http://www.veco-nyc.com/#sle).
    - d. \_\_\_\_\_.
  - 2. Substitutions: See Section 01 60 00 - Product Requirements.
  - 3. Source Limitations: Furnish vibration-isolated equipment support bases and associated components and accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.
- ### **B. Vibration-Isolated Structural Steel Bases:**
- 1. Description: Engineered structural steel frames with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
- ### **C. Vibration-Isolated Concrete Inertia Bases:**
- 1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
  - 2. Minimum Base Depth: 6 inches.
  - 3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.
  - 4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.
  - 5. Concrete: Filled on site with minimum 3000 psi concrete in accordance with Section 03 30 00.

## **2.4 VIBRATION ISOLATORS**

### **A. Manufacturers:**

- 1. Vibration Isolators:
  - a. ANDRE HVAC International, Inc: [www.andrehvac.com/#sle](http://www.andrehvac.com/#sle).
  - b. Kinetics Noise Control, Inc; \_\_\_\_\_: [www.kineticsnoise.com/#sle](http://www.kineticsnoise.com/#sle).

- c. Mason Industries; \_\_\_\_\_: [www.mason-ind.com/#sle](http://www.mason-ind.com/#sle).
    - d. Vibration Eliminator Company, Inc; \_\_\_\_\_: [www.vecco-nyc.com/#sle](http://www.vecco-nyc.com/#sle).
  - 2. Substitutions: See Section 01 60 00 - Product Requirements.
  - 3. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.
- B. General Requirements:
- 1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
  - 2. Spring Elements for Spring Isolators:
    - a. Color code or otherwise identify springs to indicate load capacity.
    - b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
    - c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
    - d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
    - e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
    - f. Selected to function without undue stress or overloading.
  - 3. Seismic Snubbing Elements for Seismic Isolators:
    - a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
    - b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.
- C. Vibration Isolators for Nonseismic Applications:
- 1. Resilient Material Isolator Pads:
    - a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
    - b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
    - c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
  - 2. Resilient Material Isolator Mounts, Nonseismic:
    - a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material; fail-safe type.
  - 3. Open (Unhoused) Spring Isolators:



- a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.
  - b. Bottom Load Plate: Nonskid, molded, elastomeric isolator material or steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
  - c. Furnished with integral leveling device for positioning and securing supported equipment.
- 4. Housed Spring Isolators:
  - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.
  - b. Furnished with integral elastomeric snubbing elements, nonadjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
  - c. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
  - d. Furnished with integral leveling device for positioning and securing supported equipment.
- 5. Restrained Spring Isolators, Nonseismic:
  - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop.
  - b. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
  - c. Furnished with integral leveling device for positioning and securing supported equipment.
  - d. Provides constant free and operating height.
- 6. Resilient Material Isolator Hangers, Nonseismic:
  - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.
- 7. Spring Isolator Hangers, Nonseismic:
  - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
  - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
- 8. Combination Resilient Material/Spring Isolator Hangers, Nonseismic:
  - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection

- and elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.
  - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
- D. Vibration Isolators for Seismic Applications:
  1. Resilient Material Isolator Mounts, Seismic:
    - a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.
  2. Restrained Spring Isolators, Seismic:
    - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) in series with elastomeric (e.g., neoprene, rubber) isolator material within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop; specifically designed and rated for seismic applications with integral snubbing in all directions.
    - b. Bottom Load Plate: Steel with provisions for bolting to supporting structure as required.
    - c. Furnished with integral leveling device for positioning and securing supported equipment.
    - d. Provides constant free and operating height.
  3. Resilient Material Isolator Hangers, Seismic:
    - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) isolator material for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
  4. Spring Isolator Hangers, Seismic:
    - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
    - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
  5. Combination Resilient Material/Spring Isolator Hangers, Seismic:
    - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection

and elastomeric (e.g., neoprene, rubber) isolator material for the upper hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.

- b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

## **2.5 EXTERNAL SEISMIC SNUBBER ASSEMBLIES**

### **A. Manufacturers:**

- 1. External Seismic Snubber Assemblies:
  - a. Kinetics Noise Control, Inc; \_\_\_\_\_: [www.kineticsnoise.com/#sle](http://www.kineticsnoise.com/#sle).
  - b. Mason Industries; \_\_\_\_\_: [www.mason-ind.com/#sle](http://www.mason-ind.com/#sle).
  - c. Vibration Eliminator Company, Inc; \_\_\_\_\_: [www.vecco-nyc.com/#sle](http://www.vecco-nyc.com/#sle).
- 2. Substitutions: See Section 01 60 00 - Product Requirements.
- 3. Source Limitations: Furnish external seismic snubber assemblies and associated accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

### **B. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.**

### **C. Seismic Snubbing Elements:**

- 1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
- 2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

## **2.6 SEISMIC RESTRAINT SYSTEMS**

### **A. Manufacturers:**

- 1. Seismic Restraint Systems:
  - a. AFCON, a brand of Anvil International; \_\_\_\_\_: [www.anvilintl.com/#sle](http://www.anvilintl.com/#sle).
  - b. Eaton Corporation; \_\_\_\_\_: [www.eaton.com/#sle](http://www.eaton.com/#sle).
  - c. Kinetics Noise Control, Inc; \_\_\_\_\_: [www.kineticsnoise.com/#sle](http://www.kineticsnoise.com/#sle).
  - d. Mason Industries; \_\_\_\_\_: [www.mason-ind.com/#sle](http://www.mason-ind.com/#sle).
  - e. \_\_\_\_\_.
- 2. Substitutions: See Section 01 60 00 - Product Requirements.
- 3. Source Limitations: Furnish seismic restraint system components and accessories produced by a single manufacturer and obtained from a single supplier.

- B. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.
- C. Cable Restraints:
  - 1. Comply with ASCE 19.
  - 2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
  - 3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
  - 4. Use protective thimbles for cable loops where potential for cable damage exists.
- D. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- C. Verify that conditions are satisfactory for installation prior to starting work.

#### **3.2 CODE-REQUIRED SPECIAL INSPECTIONS**

- A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or LP Consulting Engineers, Inc. in accordance with Section 01 45 33 and statement of special inspections as required by applicable building code.
- B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
  - 1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
  - 2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.
- C. Prior to starting work, to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.
- D. Special Inspection Agency services do not relieve from performing inspections and testing specified elsewhere.

#### **3.3 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.

- B. Install products in accordance with applicable requirements of NECA 1 (general workmanship).
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Secure fasteners according to manufacturer's recommended torque settings.
- E. Field-Welding (where approved by LP Consulting Engineers, Inc.): Comply with Section 05 50 00.
- F. Install flexible conduit and cable connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- G. Vibration Isolation Systems:
  - 1. Vibration-Isolated Equipment Support Bases:
    - a. Provide specified minimum clearance beneath base.
  - 2. Spring Isolators:
    - a. Position equipment at operating height; provide temporary blocking as required.
    - b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
    - c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
  - 3. Isolator Hangers:
    - a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
    - b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
  - 4. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
  - 5. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
  - 6. Adjust isolators to be free of isolation short circuits during normal operation.
  - 7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.
- H. Seismic Controls:
  - 1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris or other obstructions.
  - 2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.

3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
4. Equipment with Sheet Metal Housings:
  - a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
  - b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
  - c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
5. Concrete Housekeeping Pads:
  - a. Size in accordance with seismic design to meet anchor requirements.
  - b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
6. Seismic Restraint Systems:
  - a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
  - b. Install restraints within permissible angles in accordance with seismic design.
  - c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
  - d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
  - e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

### **3.4 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect vibration isolation and/or seismic control components for damage and defects.
- C. Provide services of a manufacturer's authorized representative for vibration isolation systems and seismic controls to observe installation and assist in inspection and testing. Include manufacturer's detailed testing and inspection procedures and field reports with submittals.
- D. Vibration Isolation Systems:
  1. Verify isolator static deflections.
  2. Verify required clearance beneath vibration-isolated equipment support bases.
  3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

- E. Seismic Controls:
  - 1. Verify snubbing element air gaps.
- F. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.
- G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

### **3.5 ATTACHMENTS**

- A. Statement of special inspections.

**SECTION 26 05 53**  
**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Floor marking tape.
- G. Warning signs and labels.

**1.2 RELATED REQUIREMENTS**

- A. Section 09 91 13 - Exterior Painting.
- B. Section 09 91 23 - Interior Painting.
- C. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- D. Section 26 05 73 - Power System Studies: Arc flash hazard warning labels.
- E. Section 26 27 26 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.
- F. Section 26 31 00 - Photovoltaic Collectors: Additional identification requirements for photovoltaic systems.

**1.3 REFERENCE STANDARDS**

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2023.
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.
- E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:



1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
2. Do not install identification products until final surface finishes and painting are complete.

## **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.
- D. Samples:
  1. Identification Nameplates: One of each type and color specified.
  2. Warning Signs and Labels: One of each type and legend specified.
- E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

## **1.6 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.

## **1.7 FIELD CONDITIONS**

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

# **PART 2 PRODUCTS**

## **2.1 IDENTIFICATION REQUIREMENTS**

- A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.
- B. Identification for Equipment:
  1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
    - a. Switchboards:
      - 1) Identify ampere rating.
      - 2) Identify voltage and phase.
      - 3) Identify power source and circuit number. Include location when not within sight of equipment.
      - 4) Use identification nameplate to identify main overcurrent protective device.
      - 5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
    - b. Panelboards:

- 1) Identify ampere rating.
  - 2) Identify voltage and phase.
  - 3) Identify power source and circuit number. Include location when not within sight of equipment.
  - 4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
  - 5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
  - 6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
- c. Transformers:
- 1) Identify kVA rating.
  - 2) Identify voltage and phase for primary and secondary.
  - 3) Identify power source and circuit number. Include location when not within sight of equipment.
  - 4) Identify load(s) served. Include location when not within sight of equipment.
- d. Enclosed switches, circuit breakers, and motor controllers:
- 1) Identify voltage and phase.
  - 2) Identify power source and circuit number. Include location when not within sight of equipment.
  - 3) Identify load(s) served. Include location when not within sight of equipment.
- e. Time Switches:
- 1) Identify load(s) served and associated circuits controlled. Include location.
- f. Enclosed Contactors:
- 1) Identify ampere rating.
  - 2) Identify voltage and phase.
  - 3) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).
  - 4) Identify coil voltage.
  - 5) Identify load(s) and associated circuits controlled. Include location.
- g. Centralized Emergency Lighting Inverters:
- 1) Identify input and output voltage and phase.
  - 2) Identify power source and circuit number for normal power source. Include location when not within sight of equipment.
  - 3) Identify load(s) served. Include location.
- h. Electricity Meters:

- 1) Identify load(s) metered.
2. Service Equipment:
  - a. Use identification nameplate to identify each service disconnecting means.
  - b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
3. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
4. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
5. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.
6. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
7. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
8. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
9. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
10. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
  - a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 09 91 23 and 09 91 13.
11. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
  - a. Service equipment.
12. Arc Flash Hazard Warning Labels: Comply with Section 26 05 73.
13. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.

14. Use warning signs to identify electrical hazards for entrances to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
  15. Use warning labels to identify electrical hazards for equipment, compartments, and enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
  16. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.
- C. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
  2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
  3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
    - a. At each source and load connection.
    - b. Within boxes when more than one circuit is present.
    - c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
  4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
  5. Use underground warning tape to identify direct buried cables.
- D. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
  2. Use voltage markers, color-coded bands, or factory-painted conduits to identify systems other than normal power system for accessible conduits.
    - a. Maximum Intervals: 20 feet.
    - b. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
      - 1) Field-Painting: Comply with Section 09 91 23 and 09 91 13.
      - 2) Vinyl Color Coding Electrical Tape: Comply with Section 26 05 19.
  3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall

- penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
  5. Use underground warning tape to identify underground raceways.
  6. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet.
- E. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
  2. Use voltage markers or color coded boxes to identify systems other than normal power system.
  3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
    - a. For exposed boxes in public areas, use only identification labels.
  4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
- F. Identification for Devices:
1. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.
  2. Factory Pre-Marked Wallplates: Comply with Section 26 27 26.
  3. Use identification label to identify fire alarm system devices.
    - a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
  4. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
    - a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
  5. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
  6. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.
- G. Identification for Luminaires:
1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.
- H. Identification for Photovoltaic Systems: Comply with Section 26 31 00

## **2.2 IDENTIFICATION NAMEPLATES AND LABELS**

- A. Identification Nameplates:
1. Manufacturers:

- a. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
    - b. Kolbi Pipe Marker Co; \_\_\_\_\_: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).
    - c. Seton Identification Products; \_\_\_\_\_: [www.seton.com/#sle](http://www.seton.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Materials:
    - a. Indoor Clean, Dry Locations: Use plastic nameplates.
    - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
  - 3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
    - a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
  - 4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
  - 5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
  - 6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
- 1. Manufacturers:
    - a. Brady Corporation: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
    - b. Brother International Corporation: [www.brother-usa.com/#sle](http://www.brother-usa.com/#sle).
    - c. Panduit Corp: [www.panduit.com/#sle](http://www.panduit.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
    - a. Use only for indoor locations.
  - 3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
- 1. Minimum Size: 1 inch by 2.5 inches.
  - 2. Legend:
    - a. System designation where applicable:
      - 1) Emergency Power System: Identify with text "EMERGENCY".
    - b. Equipment designation or other approved description.
    - c. Other information as indicated.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height:
    - a. System Designation: 1/2 inch.
    - b. Equipment Designation: 1/4 inch.
    - c. Other Information: 1/8 inch.

- d. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
  - 5. Color:
    - a. Normal Power System: White text on black background.
    - b. Emergency Power System: White text on red background.
- D. Format for General Information and Operating Instructions:
  - 1. Minimum Size: 1 inch by 2.5 inches.
  - 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height: 1/4 inch.
  - 5. Color: Black text on white background unless otherwise indicated.
    - a. Exceptions:
      - 1) Provide white text on red background for general information or operational instructions for emergency systems.
- E. Format for Caution and Warning Messages:
  - 1. Minimum Size: 2 inches by 4 inches.
  - 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height: 1/2 inch.
  - 5. Color: Black text on yellow background unless otherwise indicated.
- F. Format for Receptacle Identification:
  - 1. Minimum Size: 3/8 inch by 1.5 inches.
  - 2. Legend: Power source and circuit number or other designation indicated.
    - a. Include voltage and phase for other than 120 V, single phase circuits.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height: 3/16 inch.
  - 5. Color: Black text on clear background.
- G. Format for Control Device Identification:
  - 1. Minimum Size: 3/8 inch by 1.5 inches.
  - 2. Legend: Load controlled or other designation indicated.
  - 3. Text: All capitalized unless otherwise indicated.
  - 4. Minimum Text Height: 3/16 inch.
  - 5. Color: Black text on clear background.

## **2.3 WIRE AND CABLE MARKERS**

- A. Manufacturers:
  - 1. Brady Corporation; \_\_\_\_\_: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
  - 2. HellermannTyton: [www.hellermanntyton.com/#sle](http://www.hellermanntyton.com/#sle).
  - 3. Panduit Corp: [www.panduit.com/#sle](http://www.panduit.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.

- B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, or plastic sleeve type markers suitable for the conductor or cable to be identified.
- C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- D. Legend: Power source and circuit number or other designation indicated.
- E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
  - 1. Do not use handwritten text.
- F. Minimum Text Height: 1/8 inch.
- G. Color: Black text on white background unless otherwise indicated.

## **2.4 VOLTAGE MARKERS**

- A. Manufacturers:
  - 1. Brady Corporation: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
  - 2. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
  - 3. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 4. Or approved equal.
  - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.
- C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- D. Minimum Size:
  - 1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
  - 2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
  - 3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
  - 4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.
- E. Legend:
  - 1. Markers for Voltage Identification: Highest voltage present.
  - 2. Markers for System Identification:
    - a. Emergency Power System: Text "EMERGENCY".
    - b. Other Systems: Type of service.
- F. Color: Black text on orange background unless otherwise indicated.

## **2.5 UNDERGROUND WARNING TAPE**

- A. Manufacturers:
  - 1. Brady Corporation: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
  - 2. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
  - 3. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 4. Or approve equal.



- 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.
- D. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.
- E. Legend: Type of service, continuously repeated over full length of tape.
- F. Color:
  - 1. Tape for Buried Power Lines: Black text on red background.
  - 2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

## **2.6 FLOOR MARKING TAPE**

- A. Manufacturers:
  - 1. Brady Corporation: [www.bradyid.com/#sle](http://www.bradyid.com/#sle).
  - 2. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
  - 3. Insite Solutions, LLC: [www.stop-painting.com/#sle](http://www.stop-painting.com/#sle).
  - 4. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 5. Or approved equal..
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlamine, 3 inches wide, with alternating black and white stripes.

## **2.7 WARNING SIGNS AND LABELS**

- A. Manufacturers:
  - 1. Brimar Industries, Inc: [www.brimar.com/#sle](http://www.brimar.com/#sle).
  - 2. Clarion Safety Systems, LLC: [www.clarionsafety.com/#sle](http://www.clarionsafety.com/#sle).
  - 3. Insite Solutions, LLC: [www.stop-painting.com/#sle](http://www.stop-painting.com/#sle).
  - 4. Seton Identification Products: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 5. Or approved equal.
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- C. Warning Signs:
  - 1. Materials:
    - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
    - b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
  - 2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
  - 3. Minimum Size: 7 by 10 inches unless otherwise indicated.
- D. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
    - a. Do not use labels designed to be completed using handwritten text.
  2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
  3. Minimum Size: 2 by 4 inches unless otherwise indicated.
- E. Floor Signs:
1. Materials: Use factory preprinted, self-adhesive vinyl, polyester, or rubber labels with protective overlamine; removable.
  2. Minimum Size: 17-inch diameter unless otherwise indicated.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

### **3.2 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
  2. Flush-Mounted Equipment: Inside of equipment door.
  3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
  4. Elevated Equipment: Legible from the floor or working platform.
  5. Branch Devices: Adjacent to device.
  6. Interior Components: Legible from the point of access.
  7. Conduits: Legible from the floor.
  8. Boxes: Outside face of cover.
  9. Conductors and Cables: Legible from the point of access.
  10. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
1. Do not use adhesives on exterior surfaces except where substrate cannot be penetrated.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

- G. Secure rigid signs using stainless steel screws.
- H. Mark all handwritten text, where permitted, to be neat and legible.

### **3.3 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

**SECTION 26 05 73  
POWER SYSTEM STUDIES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Short-circuit study.
- B. Protective device coordination study.
- C. Arc flash and shock risk assessment.
  - 1. Includes arc flash hazard warning labels.
- D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

**1.2 RELATED REQUIREMENTS**

- A. Section 26 05 53 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.
- B. Section 26 21 00 - Low-Voltage Electrical Service Entrance.
  - 1. Includes Utility Company contact information.
- C. Section 26 24 13 - Switchboards.
- D. Section 26 24 16 - Panelboards.
- E. Section 26 28 13 - Fuses.
- F. Section 26 28 16.16 - Enclosed Switches.
- G. Section 26 33 23 - Central Battery Equipment.

**1.3 REFERENCE STANDARDS**

- A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.
- B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants; 1993 (Reaffirmed 1999).
- C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001, with Errata (2003).
- D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.
- E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.
- F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).
- G. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
  - 2. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Pre-Study Meeting: Conduct meeting with Owner to discuss system operating modes and conditions to be considered in studies.
- C. Sequencing:
  - 1. Submit study reports prior to or concurrent with product submittals.
  - 2. Do not order equipment until matching study reports and product submittals have both been evaluated by LP Consulting Engineers, Inc..
  - 3. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels (where applicable).
- D. Scheduling:
  - 1. Arrange access to existing facility for data collection with Owner.
  - 2. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.

#### **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Study preparer's qualifications.
- C. Field testing agency's qualifications.
- D. Study reports, stamped or sealed and signed by study preparer.
- E. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.
  - 1. Include characteristic time-current trip curves for protective devices.
  - 2. Include impedance data for busway.
  - 3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
  - 4. Include documentation of listed series ratings upon request.
  - 5. Identify modifications made in accordance with studies that:
    - a. Can be made at no additional cost to Owner.
    - b. As submitted will involve a change to the contract sum.

- F. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.
- G. Site-specific arc flash hazard warning labels.
- H. Field quality control reports.
- I. Certification that field adjustable protective devices have been set in accordance with requirements of studies.
- J. Project Record Documents: Revise studies as required to reflect as-built conditions.
  - 1. Include hard copies with operation and maintenance data submittals.
  - 2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

## **1.6 POWER SYSTEM STUDIES**

- A. Scope of Studies:
  - 1. Perform analysis of new electrical distribution system as indicated on drawings.
    - a. Include portions of electrical distribution system designated as "future."
  - 2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
  - 3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
    - a. Known Operating Modes:
      - 1) Utility as source.
      - 2) Maintenance settings.
- B. General Study Requirements:
  - 1. Comply with NFPA 70.
  - 2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.
- C. Data Collection:
  - 1. The Contractor shall compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
    - a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
      - 1) Obtain up-to-date information from Utility Company.
      - 2) Utility Company: To be determined by Contractor.

- b. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 00001 code letter designation.
  - c. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
  - d. Protective Devices:
    - 1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
    - 2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
  - e. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
  - f. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.
- D. Short-Circuit Study:
- 1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
  - 2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
    - a. Maximum utility fault currents.
    - b. Maximum motor contribution.
    - c. Known operating modes (e.g. utility as source, motors).
  - 3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.
- E. Protective Device Coordination Study:
- 1. Comply with applicable portions of IEEE 242 and IEEE 399.
  - 2. Analyze protective devices and associated settings for suitable margins between time-current curves to provide adequate protection for equipment and conductors while achieving full selective coordination.
- F. Arc Flash and Shock Risk Assessment:
- 1. Comply with NFPA 70E.
  - 2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
    - a. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584,

- provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
  - b. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 using single phase bolted fault current, yielding conservative results.
- 3. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.
- 4. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
  - a. Maximum and minimum utility fault currents.
  - b. Maximum and minimum motor contribution.
  - c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
- G. Study Reports:
  - 1. General Requirements:
    - a. Identify date of study and study preparer.
    - b. Identify study methodology and software product(s) used.
    - c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
    - d. Identify base used for per unit values.
    - e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
    - f. Include conclusions and recommendations.
  - 2. Short-Circuit Study:
    - a. For each scenario, identify at each bus location:
      - 1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
      - 2) Fault point X/R ratio.
      - 3) Associated equipment short circuit current ratings.
    - b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
  - 3. Protective Device Coordination Study:
    - a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
    - b. For each graph include (where applicable):
      - 1) Partial single-line diagram identifying the portion of the system illustrated.
      - 2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.



- 3) Conductors: Damage curves.
    - 4) Transformers: Inrush points and damage curves.
    - 5) Motors: Full load current, starting curves, and damage curves.
    - 6) Capacitors: Full load current and damage curves.
  - c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
    - 1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
    - 2) Include ground fault pickup and delay.
    - 3) Include fuse ratings.
    - 4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.
  - d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.
4. Arc Flash and Shock Risk Assessment:
- a. For the worst case for each scenario, identify at each bus location:
    - 1) Calculated incident energy and associated working distance.
    - 2) Calculated arc flash boundary.
    - 3) Bolted fault current.
    - 4) Arcing fault current.
    - 5) Clearing time.
    - 6) Arc gap distance.
  - b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.
  - c. Include recommendations for reducing the incident energy at locations where the calculated maximum incident energy exceeds 8 calories per sq cm.

## 1.7 QUALITY ASSURANCE

- A. Study Preparer Qualifications: Professional electrical engineer licensed in California and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.
  - 1. Study preparer may be employed by manufacturer of electrical distribution equipment.
  - 2. Study preparer may be employed by field testing agency.
- B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.
  - 1. Field Supervisor: Certified electrical testing technician; NETA ETT Level III.

- C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
  - 1. Products:
    - a. EasyPower LLC: [www.easypower.com/#sle](http://www.easypower.com/#sle).
    - b. ETAP/Operation Technology, Inc: [www.etap.com/#sle](http://www.etap.com/#sle).
    - c. Power Analytics Corporation: [www.poweranalytics.com/#sle](http://www.poweranalytics.com/#sle).
    - d. SKM Systems Analysis, Inc: [www.skm.com/#sle](http://www.skm.com/#sle).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.

## **PART 2 PRODUCTS**

### **2.1 ARC FLASH HAZARD WARNING LABELS**

- A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
  - 1. Materials: Comply with Section 26 05 53.
  - 2. Minimum Size: 4 by 6 inches.
  - 3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
    - a. Include orange header that reads "WARNING" unless otherwise indicated.
    - b. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
    - c. Include the following information:
      - 1) Arc flash boundary.
      - 2) Available incident energy and corresponding working distance.
      - 3) Site-specific PPE (personnel protective equipment) requirements.
      - 4) Nominal system voltage.
      - 5) Limited approach boundary.
      - 6) Restricted approach boundary.
      - 7) Equipment identification.
      - 8) Study preparer, report reference, and date calculations were performed.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Install arc flash warning labels in accordance with Section 26 05 53.

### **3.2 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.

- C. Inspect and test in accordance with NETA ATS, except Section 4.
- D. Adjust equipment and protective devices for compliance with studies and recommended settings.
- E. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from studies. Obtain direction before proceeding.
- F. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

### **3.3 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Training: Include as part of the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.
  - 1. Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of eight hours of training.
  - 3. Instructor: Representative of entity performing study.
  - 4. Location: At project site.

## **SECTION 26 05 83 WIRING CONNECTIONS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Electrical connections to equipment.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- B. Section 26 05 33.13 - Conduit for Electrical Systems.
- C. Section 26 05 33.16 - Boxes for Electrical Systems.
- D. Section 26 27 26 - Wiring Devices.
- E. Section 26 28 16.16 - Enclosed Switches.

#### **1.3 REFERENCE STANDARDS**

- A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).
- B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
  - 2. Determine connection locations and requirements.
- B. Sequencing:
  - 1. Install rough-in of electrical connections before installation of equipment is required.
  - 2. Make electrical connections before required start-up of equipment.

#### **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

#### **1.6 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
  - 1. Colors: Comply with NEMA WD 1.
  - 2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
  - 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Disconnect Switches: As specified in Section 26 28 16.16 and in individual equipment sections.
- C. Wiring Devices: As specified in Section 26 27 26.
- D. Flexible Conduit: As specified in Section 26 05 33.13.
- E. Wire and Cable: As specified in Section 26 05 19.
- F. Boxes: As specified in Section 26 05 33.16.

### **2.2 EQUIPMENT CONNECTIONS**

- A. \_\_\_\_\_:
  - 1. Electrical Connection: Flexible conduit.
  - 2. Provide field-installed disconnect switch.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

### **3.2 ELECTRICAL CONNECTIONS**

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.

- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
- J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

**SECTION 26 08 00**  
**ELECTRICAL COMMISSIONING REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. The purpose of this section is to specify the Contractor's responsibilities and participation in the commissioning process relative to division 26.
- B. The commissioning process is primarily the responsibility of the Commissioning Authority, with support for start-up, testing, and commissioning the responsibility of the Contractors. The commissioning process does not relieve the Contractor from participation in the process, or diminish the role and obligations to complete all portions of work in a satisfactory and fully operational manner.
- C. Work of Division 26 includes:
  - 1. Testing and start-up of the electrical equipment.
  - 2. Providing qualified personnel to assist in commissioning tests to verify equipment/ system performance.
  - 3. Completion and endorsement of pre-functional test checklists provided by the Commissioning Authority to assure that Division 26 equipment and systems are fully operational and ready for functional testing.
  - 4. Providing equipment, materials, and labor necessary to correct deficiencies found during the commissioning process which fulfill contract and warranty requirements.
  - 5. Providing training for the systems specified in Division 26 with coordination of owner by the Commissioning Authority.

**1.2 RELATED WORK**

- A. All testing and start-up procedures and documentation requirements specified within Division 26.
- B. Section 01 9100 - General Commissioning Requirements
- C. Commissioning functional test procedures that require participation of the Contractors.
- D. Cooperate with the Commissioning Authority in the following manner:
  - 1. Allow sufficient time before final completion dates so that testing can be accomplished.
  - 2. Provide labor and material to make corrections when required without undue delay.
  - 3. Coordinate all required support of that equipment which is provided to or installed with involvement of Division 23 contractors.

**PART 2 - PRODUCTS**

**2.1 TEST EQUIPMENT**

- A. Standard certified test equipment for commissioning shall be provided by the Division 26 Contractor.
- B. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist the Commissioning Authority in the commissioning process.

### **PART 3 - EXECUTION**

#### **3.1 WORK PRIOR TO COMMISSIONING**

- A. Complete all phases of work so the system can be started, tested, balanced, and otherwise commissioned. Division 26 has temporary power and start-up responsibilities with obligations to complete systems, including all sub-systems so they are functional. This includes the complete installation of all equipment and materials per the contract documents and related directives, clarifications, change orders, etc.
- B. The Commissioning Authority will develop a Commissioning Plan. Upon request of the Commissioning Authority, the Contractor shall provide assistance and consultation. The Commissioning Plan will be developed prior to completion of the installation. The Contractor is obligated to assist the Commissioning Authority in preparing the Commissioning Plan by providing all necessary information pertaining to the actual equipment and installation.
- C. Specific pre-commissioning responsibilities of Division 26 are as follows:
  - 1. Normal start-up services required to bring each system into a fully operational state. The Commissioning Authority will not begin the commissioning process until each system is complete and documented, including normal contractor start-up.
  - 2. The Contractor shall perform pre-functional tests on the equipment and systems as noted in section 01 9100 General Commissioning Requirements.
  - 3. Contractor start-up forms may be substituted for the pre-functional test forms with prior approval by the Commissioning Authority.
  - 4. Pre-functional test forms will be kept in the Contractors job trailer in a Commissioning Field Notebook provided by the Commissioning Authority.
  - 5. Factory start-up services will be provided for key equipment and systems specified in Division 26. The Contractor shall coordinate this work with the manufacturer and the Commissioning Authority.
- D. Commissioning is intended to begin upon completion of a system. Commissioning may proceed prior to the completion of systems and/or sub-systems, if expediting this work is in the best interests of the Owner. Commissioning activities and schedule will be coordinated with the Contractor. Start of commissioning before system completion will not relieve the Contractor from completing those systems as per the schedule.
- E. The Field Commissioning Notebook will be used to identify and track all pertinent commissioning documentation required during the Installation phase.



This Notebook will be assembled by the Commissioning Authority and maintained by the Contractor. The Notebook provides a central location for the Commissioning Authority to identify, copy and organize all pertinent information and will include the following format:

1. Summary describing Notebook contents and use.
2. Copy of Commissioning Plan for contractor field reference.
3. Listing of all specification documentation requirements listed by specification section, with sign off spots for appropriate contractors.
4. Tabs for each specification section with copies of pre-functional test check sheets provided by coordination of subcontractors and Commissioning Authority for contractor completion and space for related contractor-supplied documents.
5. Prior to functional testing the Commissioning Authority will use this book to verify that all appropriate contractors have completed their work and signed off that they have done so. Once the Commissioning Authority is satisfied that all components of a system are complete functional testing will begin.

### **3.2 PARTICIPATION IN COMMISSIONING**

- A. Provide skilled technicians to start up and debug all systems within the division of work. These same technicians shall be made available to assist the Commissioning Authority in completing the commissioning program as it relates to each system and their technical specialty. Work schedules, time required for testing, etc., will be requested by the Commissioning Authority and coordinated by the Contractor. Contractor will ensure the qualified technician(s) are available and present during the agreed-upon schedules and of sufficient duration to complete the necessary tests, adjustments, and/or problem resolutions.
- B. The Commissioning Authority reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or sub-system. Qualifications of technicians include expert knowledge relative to the specific equipment involved, adequate documentation and tools to service/commission the equipment, and an attitude/willingness to work with the Commissioning Authority to get the job done. A liaison or intermediary between the Commissioning Authority and qualified factory representatives does not constitute the availability of a qualified technician for purposes of this work.

### **3.3 WORK TO RESOLVE DEFICIENCIES**

- A. Maladjustments, misapplied equipment, and/or deficient performance under varying loads will result in a system that does not meet the original design intent. Correction of work will be completed under the direction of the Architect, with input from the Contractor, equipment supplier, and Commissioning Authority. Whereas all members will have input and the opportunity to discuss, debate, and work out problems, the Architect/Engineer of Record will have final

jurisdiction on the necessary work to be done to achieve performance and or design intent.

### **3.4 ADDITIONAL COMMISSIONING**

- A. Additional commissioning activities may be required after system adjustments, replacements, etc., are completed. The Contractor, suppliers, and Commissioning Authority shall include a reasonable reserve to complete this work as part of their standard contractual obligations.

### **3.5 SEASONAL COMMISSIONING AND OCCUPANCY VARIATIONS**

- A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and peak cooling seasons, as well as part-load conditions in the spring and fall. Initial commissioning will be done as soon as contract work is completed regardless of season. Subsequent commissioning may be undertaken at any time thereafter to ascertain adequate performance during the different seasons.
- B. All equipment and systems will be tested and commissioned in a peak season to observe full-load performance. The Contractor will be responsible to participate in the initial and the alternate peak season test of the systems required to demonstrate performance.
- C. Subsequent commissioning may be required under conditions of minimum and/or maximum occupancy or use. All equipment and systems affected by occupancy variations will be tested and commissioned at the minimum and peak loads to observe system performance. The Contractor will be responsible to participate in the occupancy sensitive testing of systems to provide verification of adequate performance.

### **3.6 TRAINING**

- A. The Contractor will be required to participate in the training of the Owner's engineering and maintenance staff for each mechanical system and the related components. Training may be conducted in a classroom setting, with system and component documentation, and suitable classroom training aids, or in the field with the specific equipment. The type of training will be per the Owner's option.
- B. Training will be conducted jointly with the Commissioning Authority, the design engineers, the equipment vendors, and the Contractor. The Contractor will be responsible for the generic training, as well as instructing the Owner's staff on the system peculiarities specific to this project.

### **3.7 SYSTEMS DOCUMENTATION**

- A. Contract Documents to incorporate field changes and revisions to system designs to account for actual constructed configurations will be addressed as required in Division 1. All drawings should be red-lined on two sets. Division 26 as-built drawings should include updated architectural floor plans, and the individual electrical systems in relation to actual building layout.

- B. Maintain as-built red-lines on the job site as required in Division 1.
- C. In addition to the stated requirements for operation and maintenance data, provide one copy of equipment technical literature, operation and maintenance literature, and shop drawings to the Commissioning Authority as soon as they are available. This requirement is for review of these documents prior to distribution of multiple copies for the Owner's final use.

**SECTION 26 09 23**  
**LIGHTING CONTROL DEVICES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Occupancy sensors.
- B. Outdoor motion sensors.
- C. Time switches.
- D. In-wall time switches.
- E. In-wall interval timers.
- F. Outdoor photo controls.
- G. Digital load controllers.
- H. Emergency lighting control devices.
- I. Lighting contactors.

**1.2 RELATED REQUIREMENTS**

- A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems
- D. Section 26 05 33.16 - Boxes for Electrical Systems.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 05 73 - Power System Studies.
- G. Section 26 27 26 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.
  - 1. Includes finish requirements for wall controls specified in this section.
  - 2. Includes accessory receptacles, switches, dimmers and wall plates, to match lighting controls specified in this section.
- H. Section 26 28 13 - Fuses.
- I. Section 26 51 00 - Interior Lighting.
- J. Section 26 56 00 - Exterior Lighting.
- K. Section 28 46 00 - Fire Detection and Alarm.

**1.3 REFERENCE STANDARDS**

- A. 47 CFR 15 - Radio Frequency Devices; current edition.
- B. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2023.

- C. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols; 2020.
- D. CAL TITLE 24 P6 - California Code of Regulations, Title 24, Part 6 (California Energy Code); 2022, with Supplement (2024).
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- F. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
- G. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- H. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2023.
- I. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).
- J. NEMA IA 10039 - Control Circuit and Pilot Devices; 2025.
- K. NEMA IA 10030 - Industrial Control and Systems: Enclosures; 2024.
- L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.
- N. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.
- O. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.
- P. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.
- Q. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- R. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.
- S. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.
- T. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.
- U. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.
- V. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters; Current Edition, Including All Revisions.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:

1. Coordinate placement of lighting control devices with millwork, furniture, equipment and other potential conflicts.
  2. Coordinate placement of wall switch occupancy sensors with installed door swings.
  3. Coordinate placement of occupancy sensors with millwork, furniture, equipment and other potential obstructions to motion detection coverage.
  4. Coordinate placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement.
  5. Coordinate lighting control device product selections with luminaire characteristics; see Section 26 51 00 and lighting fixture schedule.
  6. Notify LP Consulting Engineers, Inc. of conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
1. Do not install lighting control devices until final surface finishes and painting are complete.

## **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include ratings, operating modes or sequence of functions, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.
- C. Shop Drawings:
1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
  2. Digital Load Controllers: Provide dimensioned plan views indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing factory and field connections. Include manufacturer product characteristics and application instructions for wired and wireless applications, including start-up and commissioning.
  3. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.
- D. Samples:
1. Occupancy Sensors: One for each type and color specified.
  2. In-Wall Time Switches: One for each type and color specified.
  3. In-Wall Interval Timers: One for each type and color specified.
  4. Daylighting Control Photo Sensors: One for each type and color specified.

- E. Field quality control reports.
- F. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Operation and Maintenance Data: Include detailed information on device programming and setup.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Locking Receptacle-Mounted Outdoor Photo Controls: Five percent of total quantity installed for each type, but not less than two of each type.
  - 3. Electronic Trip Circuit Breakers: Provide one portable test set.
  - 4. Indicating Lights: Two of each different type.
- I. Project Record Documents: Record actual installed locations and settings for lighting control devices.

#### **1.6 QUALITY ASSURANCE**

- A. Comply with NFPA 70.
- B. Maintain at project site one copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- D. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratories (NRTL), and acceptable to authorities having jurisdiction.

#### **1.7 DELIVERY, STORAGE, AND PROTECTION**

- A. Store products in clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

#### **1.8 FIELD CONDITIONS**

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

#### **1.9 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Manufacturer Warranty: Provide manufacturer warranty for defects in material and workmanship for duration below. Complete forms in Owner's name and register with manufacturer.
  - 1. Occupancy Sensors: 5 years.

2. Utility Grade Locking Receptacle-Mounted Outdoor Photo Controls: 5 years.
3. Digital Load Controllers: 5 years.
4. Emergency Lighting Control Devices: 5 years.

## **PART 2 PRODUCTS**

### **2.1 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS**

- A. Provide products listed, classified, and labeled as suitable for purpose intended.
- B. Unless specifically indicated as excluded, provide components necessary for complete operating system including, but not limited to, conduit, wiring, connectors, hardware, and accessories.
- C. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

### **2.2 OCCUPANCY SENSORS**

- A. Manufacturers:
  1. Acuity Brands, Inc: [www.acuitybrands.com/#sle](http://www.acuitybrands.com/#sle).
  2. Hubbell Incorporated: [www.hubbell.com/#sle](http://www.hubbell.com/#sle).
  3. Intermatic, Inc: [www.intermatic.com/#sle](http://www.intermatic.com/#sle).
  4. Legrand North America, Inc: [www.legrand.us/#sle](http://www.legrand.us/#sle).
  5. Lutron Electronics Company, Inc: [www.lutron.com/#sle](http://www.lutron.com/#sle).
  6. RAB Lighting, Inc: [www.rablighting.com/#sle](http://www.rablighting.com/#sle).
  7. Substitutions: See Section 01 60 00 - Product Requirements.
  8. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.
- B. General Requirements:
  1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
  2. Sensor Technology:
    - a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
    - b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
    - c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using combination of both passive infrared and ultrasonic technologies.
    - d. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using combination of both passive infrared and audible sound sensing technologies.



3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
  4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during adjustable turn-off delay time interval.
  5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
  6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
  7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
  8. Sensitivity: Field adjustable.
  9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
  10. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above selected level.
  11. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
  12. Load Rating for Line Voltage Occupancy Sensors: As required to control load indicated on drawings.
  13. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.
  14. Where wired sensors are indicated, wireless sensors are acceptable provided that components and wiring modifications necessary for proper operation are included.
  15. Wireless Sensors:
    - a. RF Range: 30 feet through typical construction materials.
    - b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
    - c. Power: Battery-operated with minimum ten-year battery life.
- C. Wall Switch Occupancy Sensors:
1. General Requirements:
    - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
    - b. Unless otherwise indicated or required to control load indicated on drawings, provide line voltage units with self-contained relay.

- c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
  - d. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
  - e. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during delayed-off time interval.
  - f. Provide selectable audible alert to notify occupant of impending load turn-off.
  - g. Finish: Match finishes specified for wiring devices in Section 26 27 26, unless otherwise indicated.
  - h. Provide vandal resistant lenses for passive infrared (PIR) and dual technology wall switch occupancy sensors where indicated.
- 2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within area of 900 square feet.
  - 3. Ultrasonic Wall Switch Occupancy Sensors: Capable of detecting motion within area of 400 square feet.
  - 4. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within area of 900 square feet.
- D. Wall Dimmer Occupancy Sensors:
- 1. General Requirements:
    - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with field of view of 180 degrees, integrated dimming control capability, and no leakage current to load in off mode.
    - b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
    - c. Manual-Off Override Control Capability: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during delayed-off time interval.
    - d. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
    - e. Provide field adjustable dimming preset for occupied state.
    - f. Provide fade-to-off operation to notify occupant of impending load turn-off.
    - g. Finish: Match finishes specified for wiring devices in Section 26 27 26, unless otherwise indicated.
  - 2. Passive Infrared (PIR) Wall Dimmer Occupancy Sensors: Capable of detecting motion within area of 900 square feet.

E. Ceiling Mounted Occupancy Sensors:

1. General Requirements:
  - a. Description: Low profile occupancy sensors designed for ceiling installation.
  - b. Unless otherwise indicated or required to control load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
  - c. Provide field selectable setting for disabling LED motion detector visual indicator.
  - d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
  - e. Finish: White unless otherwise indicated.
2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
  - a. Standard Range Sensors: Capable of detecting motion within area of 450 square feet at mounting height of 9 feet, with field of view of 360 degrees.
  - b. Extended Range Sensors: Capable of detecting motion within area of 1,200 square feet at mounting height of 9 feet, with field of view of 360 degrees.
3. Ultrasonic Ceiling Mounted Occupancy Sensors:
  - a. Standard Range Sensors: Capable of detecting motion within area of 500 square feet at mounting height of 9 feet, with field of view of 360 degrees.
  - b. Medium Range Sensors: Capable of detecting motion within area of 1,000 square feet at mounting height of 9 feet, with field of view of 360 degrees.
  - c. Extended Range Sensors: Capable of detecting motion within area of 2,000 square feet at mounting height of 9 feet.
4. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
  - a. Standard Range Sensors: Capable of detecting motion within area of 450 square feet at mounting height of 9 feet, with field of view of 360 degrees.
  - b. Extended Range Sensors: Capable of detecting motion within area of 1,200 square feet at mounting height of 9 feet, with field of view of 360 degrees.
5. Passive Infrared/Acoustic Dual Technology Ceiling Mounted Occupancy Sensors:
  - a. Standard Range Sensors: Capable of detecting motion within area of 450 square feet at mounting height of 9 feet, with field of view of 360 degrees.
  - b. Extended Range Sensors: Capable of detecting motion within area of 1,200 square feet at mounting height of 9 feet.

F. Directional Occupancy Sensors:

1. General Requirements:
    - a. Description: Occupancy sensors designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.
    - b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
    - c. Provide field selectable setting for disabling LED motion detector visual indicator.
    - d. Finish: White unless otherwise indicated.
  2. Passive Infrared (PIR) Directional Occupancy Sensors:
    - a. Standard Range Sensors: Capable of detecting motion within distance of 40 feet at mounting height of 10 feet.
    - b. Long Range Sensors: Capable of detecting motion within distance of 80 feet at mounting height of 10 feet.
    - c. High Bay Sensors: Capable of detecting motion within distance of 50 feet at mounting height of 30 feet.
  3. Passive Infrared/Ultrasonic Dual Technology Directional Occupancy Sensors: Capable of detecting motion within distance of 40 feet at mounting height of 10 feet.
- G. Luminaire Mounted Occupancy Sensors: Designed for direct luminaire installation and control, suitable for use with specified luminaires.
- H. Power Packs for Low-Voltage Occupancy Sensors:
1. Description: Plenum rated, self-contained low-voltage class 2 transformer and relay compatible with specified low-voltage occupancy sensors for switching of line-voltage loads.
  2. Provide quantity and configuration of power and slave packs with associated wiring and accessories as required to control load indicated on drawings.
  3. Input Supply Voltage: Dual rated for 120/277 V ac.
  4. Load Rating: As required to control load indicated on drawings.
- I. Power Packs for Wireless Occupancy Sensors:
1. Description: Plenum rated, self-contained relay compatible with specified wireless occupancy sensors for switching of line-voltage loads.
  2. Input Supply Voltage: Dual rated for 120/277 V ac.
  3. Load Rating: As required to control load indicated on drawings.
  4. Provide auxiliary contact closure output where indicated.
  5. Rated Life of Relay: One million cycles.
- J. Accessories:
1. Provide heavy duty coated steel wire protective guards compatible with specified occupancy sensors where indicated on plans.

## **2.3 OUTDOOR MOTION SENSORS**

- A. Manufacturers:
  - 1. Acuity Brands, Inc: [www.acuitybrands.com/#sle](http://www.acuitybrands.com/#sle).
  - 2. Hubbell Lighting, Inc: [www.hubbelllighting.com/#sle](http://www.hubbelllighting.com/#sle).
  - 3. Legrand North America, Inc: [www.legrand.us/#sle](http://www.legrand.us/#sle).
  - 4. RAB Lighting, Inc: [www.rablighting.com/#sle](http://www.rablighting.com/#sle).
  - 5. Substitutions: See Section 01 60 00 - Product Requirements.
  - 6. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.
- B. Description: Factory-assembled wet location listed device suitable for wall or ceiling/eave mounting, with integral swivel for field adjustment of coverage, capable of detecting motion for automatic control of load indicated.
- C. Sensor Technology: Passive Infrared (PIR) designed to detect occupancy by sensing movement of thermal energy between zones.
- D. Operation: Unless otherwise indicated, motion sensor to turn load on when motion is detected and to turn load off when no motion is detected during adjustable turn-off delay time interval.
- E. Turn-Off Delay: Field adjustable, with time delay settings available up to 15 minutes.
- F. Integral Photocell: For dusk to dawn operation.
- G. Manual Override: Activated by switching power off to unit and then back on.
- H. Load Rating: 1,000 W incandescent and fluorescent load at 120 V ac.
- I. Coverage: Capable of detecting motion within distance of 50 feet at mounting height of 8 feet, with field of view of 270 degrees.
- J. Finish: Color to be selected.
- K. Provide integral lamp holders suitable for two 150 watt PAR 38 lamps.

## **2.4 TIME SWITCHES**

- A. Manufacturers:
  - 1. Intermatic, Inc: [www.intermatic.com/#sle](http://www.intermatic.com/#sle).
  - 2. NSI Industries LLC: [www.nsiindustries.com/#sle](http://www.nsiindustries.com/#sle).
  - 3. Substitutions: See Section 01 60 00 - Product Requirements.
  - 4. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.
- B. Digital Electronic Time Switches:
  - 1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
  - 2. Program Capability:
    - a. 24-Hour Time Switches: Single channel, with same schedule for each day of week and skip-a-day feature to omit selected days.

- b. 7-Day Time Switches: Single channel, capable of different schedule for each day of week with additional holiday schedule available to override normal schedule for selected days.
  - c. Astronomic Time Switches: Single channel, capable of different schedule for each day of week with additional holiday schedule available to override normal schedule for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
- 3. Schedule Capacity: Not less than 16 programmable on/off operations.
- 4. Provide automatic daylight savings time and leap year compensation.
- 5. Provide power outage backup to retain programming and maintain clock.
- 6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
- 7. Provide remote photocell input with light level adjustment.
- 8. Input Supply Voltage: As indicated on the drawings.
- 9. Output Switch Configuration: As required to control load indicated on drawings.
- 10. Output Switch Contact Ratings: As required to control load indicated on drawings.
- 11. Provide lockable enclosure; environmental type per NEMA EN 10250 as specified for the following installation locations:
  - a. Indoor clean, dry locations: Type 1.
  - b. Outdoor locations: Type 3R.
- 12. Provide flush-mounted unit where indicated, where mounted in public areas, or where mounted adjacent to flush-mounted equipment.
- C. Electromechanical Time Switches:
  - 1. Description: Factory-assembled controller with motor-operated timing dial mechanism and adjustable trippers for setting on/off operations, listed and labeled as complying with UL 917.
  - 2. Program Capability:
    - a. 24-Hour Time Switches: With same schedule for each day of week and skip-a-day feature to omit selected days.
    - b. 7-Day Time Switches: Capable of different schedule for each day of week.
    - c. Astronomic Time Switches: With same schedule for each day of week and skip-a-day feature to omit selected days with automatic adjustment for seasonal changes in sunrise and sunset times.
  - 3. Schedule Capacity:
    - a. 24-Hour Time Switches: Accommodating not less than 12 pairs of selected on/off operations per day.
    - b. 7-Day Time Switches: Accommodating not less than two pairs of selected on/off operations per day.
    - c. Astronomic Time Switches: Capable of turning load on at sunset and off at either sunrise or selected fixed time.

4. Provide spring reserve backup to maintain clock during power outage.
5. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
6. Input Supply Voltage: As indicated on the drawings.
7. Output Switch Configuration: As required to control load indicated on drawings.
8. Output Switch Contact Ratings: As required to control load indicated on drawings.
9. Provide lockable enclosure; environmental type per NEMA EN 10250 as specified for the following installation locations:
  - a. Indoor clean, dry locations: Type 1.
  - b. Outdoor locations: Type 3R.
10. Provide flush-mounted unit where indicated, where mounted in public areas, or where mounted adjacent to flush-mounted equipment.

## **2.5 IN-WALL TIME SWITCHES**

- A. Manufacturers:
  1. Intermatic, Inc: [www.intermatic.com/#sle](http://www.intermatic.com/#sle).
  2. NSI Industries LLC: [www.nsiindustries.com/#sle](http://www.nsiindustries.com/#sle).
  3. Substitutions: See Section 01 60 00 - Product Requirements.
  4. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.
- B. Digital Electronic In-Wall Time Switches:
  1. Description: Factory-assembled solid state programmable controller with LCD display, suitable for mounting in standard wall box, and listed and labeled as complying with UL 916 or UL 917.
  2. Program Capability:
    - a. 7-Day Time Switches: Capable of different schedule for each day of week.
    - b. Astronomic Time Switches: Capable of different schedule for each day of week and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
  3. Schedule Capacity: Not less than 40 programmable on/off operations.
  4. Provide automatic daylight savings time compensation.
  5. Provide power outage backup to retain programming and maintain clock.
  6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
  7. Switch Configuration: Suitable for use in either SPST or 3-way application.
  8. Contact Ratings: As required to control load indicated on drawings.
- C. Electromechanical In-Wall Time Switches:
  1. Description: Factory-assembled controller with motor-operated timing dial mechanism and adjustable trippers for setting on/off operations, suitable

- for mounting in standard wall box, and listed and labeled as complying with UL 917.
2. Program Capability: 24-hour time switch with same schedule for each day of week.
  3. Schedule Capacity: Accommodating not less than 24 selected on/off operations per day.
  4. Manual override: Capable of permanently overriding current schedule.
  5. Switch Configuration: SPST.
  6. Contact Ratings: As required to control load indicated on drawings.

## **2.6 IN-WALL INTERVAL TIMERS**

- A. Manufacturers:
  1. Intermatic, Inc: [www.intermatic.com/#sle](http://www.intermatic.com/#sle).
  2. NSI Industries LLC: [www.nsiindustries.com/#sle](http://www.nsiindustries.com/#sle).
  3. Substitutions: See Section 01 60 00 - Product Requirements.
  4. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.
- B. Digital Electronic In-Wall Interval Timers:
  1. Description: Factory-assembled solid state programmable controller with LCD display, suitable for mounting in standard wall box, and listed and labeled as complying with UL 916 or UL 917.
  2. Program Capability: Designed to turn load off at end of preset time interval.
  3. Time Interval: Field selectable range of presets available up to 12 hours.
  4. Provide field selectable audible and visual indication to warn that end of interval operation is about to turn off load.
  5. Provide power outage backup to retain programming and maintain clock.
  6. Manual override: Capable of both turning load off and resetting timer to original preset time interval.
  7. Switch Configuration: Suitable for use in either SPST or 3-way application.
  8. Contact Ratings: As required to control load indicated on drawings.
- C. Spring Wound In-Wall Interval Timers:
  1. Description: Factory-assembled controller with mechanical spring wound timing mechanism requiring no electricity to operate; suitable for mounting in standard wall box; rotary control operator with matching wall plate factory marked with time interval units; listed and labeled as complying with UL 916 or UL 917.
  2. Program Capability: Designed to turn load off at end of preset time interval.
  3. Time Interval: User selectable from zero up to 15 minutes.
  4. Manual override: Provide hold feature to disable timer for constant on operation.
  5. Switch Configuration: SPST.



6. Contact Ratings: As required to control load indicated on drawings.

## **2.7 OUTDOOR PHOTO CONTROLS**

- A. Manufacturers:
  1. Intermatic, Inc: [www.intermatic.com/#sle](http://www.intermatic.com/#sle).
  2. NSI Industries LLC: [www.nsiindustries.com/#sle](http://www.nsiindustries.com/#sle).
  3. Substitutions: See Section 01 60 00 - Product Requirements.
  4. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.
- B. Stem-Mounted Outdoor Photo Controls:
  1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
  2. Housing: Weatherproof, impact resistant polycarbonate.
  3. Photo Sensor: Cadmium sulfide.
  4. Provide external sliding shield for field adjustment of light level activation.
  5. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
  6. Voltage: As required to control load indicated on drawings.
  7. Failure Mode: Fails to the on position.
  8. Load Rating: As required to control load indicated on drawings.
  9. Provide accessory wall-mounting bracket where indicated or as required to complete installation.
- C. Locking Receptacle-Mounted Outdoor Photo Controls
  1. Description: Plug-in locking type photo control unit complying with ANSI C136.10 for mounting on compatible receptacle, listed and labeled as complying with UL 773.
  2. Housing: Weatherproof, impact resistant UV stabilized polypropylene, color to be selected.
  3. Photo Sensor: Cadmium sulfide.
  4. Light Level Activation: 1 to 3 footcandles turn-on and 1.5 to 1 turn-off to turn-on ratio with instant turn-on and delayed turn-off.
  5. Voltage: As required to control load indicated on drawings.
  6. Failure Mode: Fails to the on position.
  7. Load Rating: As required to control load indicated on drawings.
  8. Surge Protection: 160 joule metal oxide varistor.
  9. Provide the following accessories where indicated or as required to complete installation:
    - a. Receptacle: Complying with ANSI C136.10.
    - b. Mounting Bracket.
    - c. Shorting Cap: Suitable for replacing locking photo control to complete circuit.
- D. Button Type Outdoor Photo Controls

1. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.
2. Housing: Weather resistant polycarbonate.
3. Photo Sensor: Cadmium sulfide.
4. Light Level Activation: 1 to 3 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
5. Voltage: As required to control load indicated on drawings.
6. Failure Mode: Fails to the on position.
7. Load Rating: As required to control load indicated on drawings.

## **2.8 DIGITAL LOAD CONTROLLERS**

- A. Manufacturers:
- B. Hubbell Control Solutions: [www.hubbell.com/hubbellcontrolsolutions/en/#sle](http://www.hubbell.com/hubbellcontrolsolutions/en/#sle).
  1. Intermatic, Inc: [www.intermatic.com/#sle](http://www.intermatic.com/#sle).
  2. Lutron Electronics Company, Inc: [www.lutron.com/#sle](http://www.lutron.com/#sle).
  3. Sensor Switch Inc: [www.sensorswitch.com/#sle](http://www.sensorswitch.com/#sle).
  4. WattStopper: [www.wattstopper.com/#sle](http://www.wattstopper.com/#sle).
- C. Additional Integrated Requirements for Digital Load Controllers:
- D. Accessories:
  1. Where indicated, provide compatible accessory wireless controls for manual override control.

## **2.9 EMERGENCY LIGHTING CONTROL DEVICES**

- A. Manufacturers:
  1. Evenlite, Inc: [www.evenlite.com/#sle](http://www.evenlite.com/#sle).
  2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Automatic Load Control Relays:
  1. Listed and labeled as complying with UL 924.
  2. Bypass/shunt lighting controls upon loss of normal power source to turn controlled emergency lighting loads on at full light output.
- C. Branch Circuit Emergency Lighting Transfer Switches (BCE LTS):
  1. Listed and labeled as complying with UL 1008.
  2. Transfer controlled emergency lighting loads from normal power source to emergency power source.
- D. Devices Installed in Spaces Used for Environmental Air: Plenum rated, suitable for use in air-handling spaces; listed and labeled as complying with UL 2043.
- E. Provide integral fire alarm interface to activate emergency mode via signal from fire alarm panel.
  1. See Section 28 46 00.
- F. Provide compatible listed accessory remote test switch where indicated on drawings.

- G. Lighting Contactors
- H. Manufacturers:
  - 1. ABB; \_\_\_\_\_: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
  - 2. Eaton Corporation; \_\_\_\_\_: [www.eaton.com/#sle](http://www.eaton.com/#sle).
  - 3. Rockwell Automation Inc; \_\_\_\_\_: [www.rockwellautomation.com/#sle](http://www.rockwellautomation.com/#sle).
  - 4. Schneider Electric; \_\_\_\_\_: [www.se.com/#sle](http://www.se.com/#sle).
  - 5. Siemens Industry, Inc; \_\_\_\_\_: [www.new.siemens.com/#sle](http://www.new.siemens.com/#sle).
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- I. Description: Magnetic lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on drawings.
- J. Combination Contactors: NEMA ICS 2, Class A combination controllers with magnetic contactors and externally operable disconnect.
  - 1. Disconnects: Circuit breaker type.
    - a. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening cover with disconnect in the ON position with capability of overriding interlock for testing purposes.
    - b. Provide auxiliary interlock for disconnection of external control power sources where applicable.
- K. Short Circuit Current Rating:
  - 1. Provide contactors with listed short circuit current rating not less than available fault current at installed location as indicated on the drawings.
- L. Enclosures:
  - 1. Comply with NEMA IA 10030.
  - 2. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1 or Type 12.
    - b. Outdoor Locations: Type 3R or Type 4.
  - 3. Finish: Manufacturer's standard unless otherwise indicated.
  - 4. Accessories
  - 5. Auxiliary Contacts:
    - a. Comply with NEMA IA 10039.
    - b. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each lighting contactor, minimum.
  - 6. Pilot Devices:
    - a. Comply with NEMA IA 10039; heavy-duty type.
    - b. Nominal Size: 30 mm.

- c. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
  - d. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
  - e. Indicating Lights: Push-to-test type unless otherwise indicated.
  - f. Provide LED lamp source for indicating lights and illuminated devices.
- 7. Control and Timing Relays:
  - a. Comply with NEMA IA 10039.
  - b. Provide number and type of relays indicated or required to perform necessary functions.
  - c. Timing Relays: Electronic or pneumatic as indicated.
    - 1) Adjustable Timing Range: As indicated on drawings.
- 8. Fire-Rated Device Enclosures:
  - a. Manufacturers:
    - 1) Fire Rated Product Specialties Corp; \_\_\_\_\_: [www.frpsonline.com/#sle](http://www.frpsonline.com/#sle).
    - 2) Substitutions: See Section 01 60 00 - Product Requirements.
  - b. Provide as required to preserve fire resistance rating of building elements.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
- F. Verify that service voltage and ratings of lighting control devices are appropriate for service voltage and load requirements at location to be installed.
- G. Verify that conditions are satisfactory for installation prior to starting work.

### **3.2 PREPARATION**

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

### **3.3 INSTALLATION**

- A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes as required for installation of lighting control devices; see Section 26 05 33.16.
  - 1. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
  - 2. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify LP Consulting Engineers, Inc. to obtain direction prior to proceeding with work.
- C. Maintain separation of remote-control, signaling, and power-limited circuits.
  - 1. See manufacturer instructions and Section 26 05 19 for control wiring conductors, wiring methods, and identification requirements.
- D. Install lighting control devices in accordance with manufacturer's instructions.
- E. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- F. Install lighting control devices plumb and level, and held securely in place.
- G. Where required and not furnished with lighting control device, provide wall plate; see Section 26 27 26.
- H. Provide required supports; see Section 26 05 29.
- I. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- J. Identify lighting control devices; see Section 26 05 53.
- K. Occupancy Sensor Locations:
  - 1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
  - 2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
- L. Outdoor Photo Control Locations:

1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
  2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by photo control itself.
- M. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into photo control.
- N. Daylighting Control Photo Sensor Locations:
1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for proper control of respective room or area based on manufacturer's recommendations for installed devices.
  2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure light level controlled at designated task location, while minimizing measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
  3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into space, while minimizing measured amount of lighting from artificial sources.
- O. Combination Enclosed Lighting Contactors:
1. Except where indicated to be mounted adjacent to equipment they supply, mount lighting contactors such that highest position of operating handle does not exceed 79 inches above floor or working platform.
  2. Provide fuses for fusible switches as indicated; see Section 26 28 13.
- P. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.
- Q. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near sensor location.
- R. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.
- S. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.
- T. Where indicated or required, provide cabinet or enclosure for mounting of lighting control device system components; see Section 26 05 33.16.
- 3.4 FIELD QUALITY CONTROL**
- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
  - B. Inspect each lighting control device for damage and defects.

- C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
- D. Test time switches to verify proper operation.
- E. Test outdoor photo controls to verify proper operation, including time delays where applicable.
- F. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.
- G. Correct wiring deficiencies and replace damaged or defective conductors, cables, and lighting control devices.

### **3.5 ADJUSTING**

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by LP Consulting Engineers, Inc..
- C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.
- D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.
- E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by LP Consulting Engineers, Inc.. Record settings in written report to be included with submittals.
- F. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by LP Consulting Engineers, Inc..
- G. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by LP Consulting Engineers, Inc..

### **3.6 CLEANING**

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

### **3.7 COMMISSIONING**

- A. See Section 01 91 13 - General Commissioning Requirements for commissioning requirements.

### **3.8 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of lighting control devices to LP Consulting Engineers, Inc., and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of two hours of training.
  - 3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of installed lighting control devices.
  - 4. Location: At project site.



**SECTION 26 21 00**  
**LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Electrical service requirements.

**1.2 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Materials and installation requirements for cast-in-place concrete equipment pads.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- D. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- E. Section 26 05 33.13 - Conduit for Electrical Systems.
- F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 24 13 - Switchboards: Service entrance equipment.
  - 1. Includes utility metering transformer compartment.
  - 2. Includes non-utility electrical metering.
- H. Section 26 24 16 - Panelboards: Service entrance equipment.
- I. Section 26 28 16.16 - Enclosed Switches: Service entrance equipment.
- J. Section 26 31 00 - Photovoltaic Collectors: Photovoltaic system for interconnection with normal utility electrical supply.
- K. Section 26 43 00 - Surge Protective Devices: Service entrance surge protective devices.
- L. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

**1.3 PRICE AND PAYMENT PROCEDURES**

- A. Allowances:
  - 1. See Section 01 21 00 - Allowances, for allowances affecting this section.
  - 2. Include cash allowance for Utility Company charges associated with providing service.
- B. Unit Prices:
  - 1. See Section 01 22 00 - Unit Prices, for additional unit price requirements.
  - 2. Primary:
    - a. Basis of Measurement: By the lineal foot, for each configuration.
    - b. Basis of Payment: Includes all work designated to be provided by in "Division of Responsibility" under Part 2 article "Electrical Service Requirements" below, including purchase, delivery, and installation.
  - 3. Secondary:
    - a. Basis of Measurement: By the lineal foot, for each configuration.

- b. Basis of Payment: Includes all work designated to be provided by in "Division of Responsibility" under Part 2 article "Electrical Service Requirements" below, including purchase, delivery, and installation.
- 4. Transformer Pad/Vault:
  - a. Basis of Measurement: Per unit, for each type.
  - b. Basis of Payment: Includes purchase, delivery, and installation.

#### **1.4 DEFINITIONS**

- A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

#### **1.5 REFERENCE STANDARDS**

- A. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### **1.6 ADMINISTRATIVE REQUIREMENTS**

- A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.
- B. Coordination:
  - 1. Verify the following with Utility Company representative:
    - a. Utility Company requirements, including division of responsibility.
    - b. Exact location and details of utility point of connection.
    - c. Utility easement requirements.
    - d. Utility Company charges associated with providing service.
  - 2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
  - 3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 4. Coordinate the work with other installers to provide communication lines required for Utility Company meters.
  - 5. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.
- D. Utility Company charges associated with providing permanent service to be paid by Contractor..
- E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.

- F. Scheduling:
  - 1. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.
  - 2. Arrange for inspections necessary to obtain Utility Company approval of installation.

#### **1.7 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Utility Company letter of availability for providing electrical service to project.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.
- D. Shop Drawings: Include dimensioned plan views and sections indicating locations and arrangement of Utility Company and service entrance equipment, metering provisions, required clearances, and proposed service routing.
  - 1. Obtain Utility company approval of shop drawings prior to submittal.
- E. Drawings prepared by Utility Company.
- F. Project Record Documents: Record actual locations of equipment and installed service routing.

#### **1.8 QUALITY ASSURANCE**

- A. Comply with the following:
  - 1. IEEE C2 (National Electrical Safety Code).
  - 2. NFPA 70 (National Electrical Code).
  - 3. The requirements of the Utility Company.
  - 4. The requirements of the local authorities having jurisdiction.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Products: Listed, classified, and labeled as suitable for the purpose intended.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation (including outdoor rated products which are not weatherproof until completely and properly installed). Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

- C. Handle products carefully to avoid damage to internal components, enclosure, and finish.

## **PART 2 PRODUCTS**

### **2.1 ELECTRICAL SERVICE REQUIREMENTS**

- A. Provide new electrical service consisting of all required conduits, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.
- B. Electrical Service Characteristics:
  - 1. Service Type: Underground or Overhead as indicated on drawings.
  - 2. Service Voltage: As indicated on the drawings.
  - 3. Service Size: As indicated on the drawings.
- C. Utility Company: As indicated on drawings, to be Contractor verified.
- D. Division of Responsibility:
  - 1. Pad-Mounted Utility Transformers:
    - a. Transformer Vaults and Pads: Furnished and installed by Contractor per Utility Company requirements.
    - b. Transformers: Furnished and installed by Utility Company.
    - c. Transformer Grounding Provisions: Furnished and installed by Contractor per Utility Company requirements.
    - d. Transformer Protective Bollards: Furnished and installed by Contractor per Utility Company requirements.
    - e. Primary:
      - 1) Trenching and Backfilling: Provided by Contractor.
      - 2) Conduits: Furnished and installed by Contractor.
      - 3) Conductors: Furnished and installed by Utility Company unless noted otherwise..
    - f. Secondary:
      - 1) Trenching and Backfilling: Provided by Contractor.
      - 2) Conduits: Furnished and installed by Contractor.
      - 3) Conductors: Furnished and installed by Contractor (Service Point at transformer).
  - 2. Terminations at Service Point: Provided by Utility Company.
  - 3. Metering Provisions:
    - a. Meter Bases: Furnished and installed by Contractor per Utility Company requirements.
    - b. Metering Transformer Cabinets: Furnished and installed by Contractor per Utility Company requirements.
    - c. Metering Compartments in Service Entrance Equipment: Furnished and installed by Contractor per Utility Company requirements.
    - d. Metering Transformers: Furnished and installed by Utility Company.

- e. Conduits Between Metering Transformers and Meters: Furnished and installed by Contractor per Utility Company requirements.
  - f. Wiring Between Metering Transformers and Meters: Furnished and installed by Utility Company.
  - g. Communications Conduits for Meters: Furnished and installed by Contractor per Utility Company requirements.
- E. Products Furnished by : Comply with Utility Company requirements.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.
- C. Verify that conditions are satisfactory for installation prior to starting work.

#### **3.2 PREPARATION**

- A. Verify and mark locations of existing underground utilities.

#### **3.3 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions and Utility Company requirements.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances and required maintenance access.
- D. Provide required trenching and backfilling in accordance with Section 31 23 16.13.
- E. Construct cast-in-place concrete pads for utility equipment in accordance with Utility Company requirements and Section 03 30 00.
- F. Provide required protective bollards in accordance with Utility Company requirements.
- G. Provide required support and attachment components in accordance with Section 26 05 29.
- H. Provide grounding and bonding for service entrance equipment in accordance with Section 26 05 26.
- I. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 05 53.

#### **3.4 PROTECTION**

- A. Protect installed equipment from subsequent construction operations.

**SECTION 26 22 00**  
**LOW-VOLTAGE TRANSFORMERS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. General purpose transformers.

**1.2 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 33.13 - Conduit for Electrical Systems: Flexible conduit connections.
- E. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
  - 1. Includes requirements for the seismic qualification of equipment specified in this section.
- F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 24 16 - Panelboards.

**1.3 REFERENCE STANDARDS**

- A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers; Current Edition.
- B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers; 2015.
- C. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers; 2013.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers; 2015.
- F. NEMA ST 20 - Dry Type Transformers for General Applications; 2021.
- G. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- H. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 506 - Standard for Specialty Transformers; Current Edition, Including All Revisions.

- K. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers; Current Edition, Including All Revisions.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
  - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  - 5. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.
- C. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.
  - 1. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.
- E. Source Quality Control Test Reports: Include reports for tests designated in NEMA ST 20 as design and routine tests.
- F. Field Quality Control Test Reports.
- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- H. Maintenance Data: Include recommended maintenance procedures and intervals.
- I. Project Record Documents: Record actual locations of transformers.

#### **1.6 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

#### **1.8 FIELD CONDITIONS**

- A. Ambient Temperature: Do not exceed the following maximum temperatures during and after installation of transformers.
  - 1. Greater than 10 kVA: 104 degrees F maximum.
  - 2. Less than 10 kVA: 77 degrees F maximum.

#### **1.9 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

### **PART 2 PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. ABB: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
- B. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
- C. Schneider Electric: [www.se.com/#sle](http://www.se.com/#sle).
- D. Siemens Industry, Inc: [www.new.siemens.com/#sle](http://www.new.siemens.com/#sle).
- E. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Source Limitations: Provide transformers produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

#### **2.2 TRANSFORMERS - GENERAL REQUIREMENTS**

- A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.
- B. Seismic Qualification: Provide transformers suitable for application under seismic design criteria in accordance with Section 26 05 48 where required. Include certification of compliance with submittals.



- C. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
  - 1. Altitude: Less than 3,300 feet.
  - 2. Ambient Temperature:
    - a. Greater than 10 kVA: Not exceeding 104 degrees F.
    - b. Less than 10 kVA: Not exceeding 77 degrees F.
- D. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.
- E. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.
- F. Basic Impulse Level: 10 kV.
- G. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- H. Isolate core and coil from enclosure using vibration-absorbing mounts.
- I. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

## **2.3 GENERAL PURPOSE TRANSFORMERS**

- A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.
- B. Primary Voltage: 480 volts delta, 3 phase.
- C. Secondary Voltage: 208Y/120 volts, 3 phase.
- D. Insulation System and Allowable Average Winding Temperature Rise:
  - 1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
  - 2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.
- E. Coil Conductors: Continuous copper windings with terminations brazed or welded.
- F. Winding Taps:
  - 1. Less than 3 kVA: None.
  - 2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
  - 3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
  - 4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.
- G. Energy Efficiency: Comply with 10 CFR 431, Subpart K.

- H. Sound Levels: Standard sound levels complying with NEMA ST 20
- I. Mounting Provisions:
  - 1. Less than 15 kVA: Suitable for wall mounting.
  - 2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
  - 3. Larger than 75 kVA: Suitable for floor mounting.
- J. Transformer Enclosure: Comply with NEMA ST 20.
  - 1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor clean, dry locations: Type 2.
    - b. Outdoor locations: Type 3R.
  - 2. Construction: Steel.
    - a. Less than 15 kVA: Totally enclosed, non-ventilated.
    - b. 15 kVA and Larger: Ventilated.
  - 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
  - 4. Provide lifting eyes or brackets.
- K. Accessories:
  - 1. Mounting Brackets: Provide manufacturer's standard brackets.
  - 2. Weathershield Kits: Provide for ventilated transformers installed outdoors to provide a listed NEMA EN 10250, type 3R assembly.
  - 3. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

## **2.4 SOURCE QUALITY CONTROL**

- A. Factory test transformers according to NEMA ST 20.
- B. Sound Level Tests: Perform factory test designated in NEMA ST 20 as "design" test on each production unit.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.
- C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.
- D. Verify that conditions are satisfactory for installation prior to starting work.

### **3.2 INSTALLATION**

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install transformers in accordance with NECA 409 and IEEE C57.94.

- D. Use flexible conduit, under the provisions of Section 26 05 33.13, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.
- F. Install transformers plumb and level.
- G. Transformer Support:
  - 1. Provide required support and attachment in accordance with Section 26 05 29, where not furnished by transformer manufacturer.
  - 2. Provide required vibration isolation and/or seismic controls in accordance with Section 26 05 48.
  - 3. Use integral transformer flanges, accessory brackets furnished by manufacturer, or field-fabricated supports to support wall-mounted transformers.
  - 4. Unless otherwise indicated, mount floor-mounted transformers on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.
  - 5. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- H. Provide grounding and bonding in accordance with Section 26 05 26.
- I. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.
- J. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.
- K. Where furnished as a separate accessory, install transformer weathershield per manufacturer's instructions.
- L. Identify transformers in accordance with Section 26 05 53.

### **3.3 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS Sections 7.2.1.1 and 7.2.1.2. Tests and inspections listed as optional are not required.

### **3.4 ADJUSTING**

- A. Measure primary and secondary voltages and make appropriate tap adjustments.
- B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

### **3.5      CLEANING**

- A.    Clean dirt and debris from transformer components according to manufacturer's instructions.
- B.    Repair scratched or marred exterior surfaces to match original factory finish.

## **SECTION 26 24 13 SWITCHBOARDS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.
- B. Overcurrent protective devices for switchboards.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
  - 1. Includes requirements for the seismic qualification of equipment specified in this section.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
- G. Section 26 21 00 - Low-Voltage Electrical Service Entrance.
  - 1. Includes Utility Company contact information.
- H. Section 26 43 00 - Surge Protective Devices.

#### **1.3 REFERENCE STANDARDS**

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).
- B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- D. NECA 400 - Standard for Installing and Maintaining Switchboards; 2007.
- E. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- F. NEMA PB 2 - Deadfront Distribution Switchboards; 2011.
- G. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 1000 Volts or Less; 2023.
- H. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- K. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.
- L. UL 891 - Switchboards; Current Edition, Including All Revisions.
- M. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  - 4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
  - 5. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Service Entrance Switchboards:
  - 1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
  - 2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
  - 3. See Section 26 21 00 for Utility Company contact information and additional requirements.
  - 4. Obtain Utility Company approval of switchboard prior to fabrication.
  - 5. Preinstallation Meeting: Convene one week prior to commencing work of this section to review requirements with Utility Company representative.
  - 6. Arrange for inspections necessary to obtain Utility Company approval of installation.

#### **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit

entry locations, conductor terminal information, and installed features and accessories.

1. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.
- E. Field Quality Control Test Reports.
- F. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Enclosure Keys: Two of each different key.
  3. Electronic Trip Circuit Breakers: Provide one portable test set.

## **1.6 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.
- B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.
- C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

## **1.8 FIELD CONDITIONS**

- A. Maintain field conditions within required service conditions during and after installation.

# **PART 2 PRODUCTS**

## **2.1 MANUFACTURERS**

- A. Switchboards:
  1. ABB: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
  2. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
  3. Schneider Electric: [www.se.com/#sle](http://www.se.com/#sle).
  4. Siemens Industry, Inc: [www.new.siemens.com/#sle](http://www.new.siemens.com/#sle).

5. Substitutions: See Section 01 60 00 - Product Requirements.
6. Source Limitations: Provide switchboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

## **2.2 SWITCHBOARDS**

- A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.
- D. Front-Connected Switchboards:
  1. Main Device(s): Individually-mounted.
  2. Feeder Devices: Panel/group-mounted.
  3. Arrangement: Front accessible only (not rear accessible), rear aligned.
  4. Gutter Access: Bolted covers.
- E. Rear-Connected Switchboards:
  1. Main Device(s): Individually-mounted.
  2. Feeder Devices: Individually-mounted.
  3. Compartmentalization: Provide barriered compartments for each overcurrent protective device, distribution bus, and rear cable connection area.
  4. Arrangement: Rear accessible, front and rear aligned.
  5. Rear Access: Bolted covers.
- F. Service Entrance Switchboards:
  1. Listed and labeled as suitable for use as service equipment according to UL 869A.
  2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
  3. Comply with Utility Company requirements for electrical service.
  4. Utility Metering Provisions: Provide separate barriered compartment complying with Utility Company requirements where indicated or where required by Utility Company. Include hinged sealable door and provisions for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps as required.
- G. Seismic Qualification: Provide switchboards and associated components suitable for application under the seismic design criteria specified in Section 26 05 48 where required. Include certification of compliance with submittals.
- H. Service Conditions:



1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
    - a. Altitude: Less than 6,600 feet.
    - b. Ambient Temperature:
      - 1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F and 104 degrees F.
      - 2) Switchboards Containing Fusible Switches: Between -22 degrees F and 104 degrees F.
  2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
- I. Short Circuit Current Rating:
1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
  2. Minimum Rating: 65,000 rms symmetrical amperes.
  3. Listed series ratings are not acceptable.
- J. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- K. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.
- L. Bussing: Sized in accordance with UL 891 temperature rise requirements.
1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
  2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
  3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
  4. Phase and Neutral Bus Material: Aluminum.
  5. Ground Bus Material: Copper.
- M. Conductor Terminations: Suitable for use with the conductors to be installed.
1. Line Conductor Terminations:
    - a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
    - b. Main and Neutral Lug Type: Mechanical.
  2. Load Conductor Terminations:
    - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
    - b. Lug Type:
      - 1) Provide mechanical lugs unless otherwise indicated.
      - 2) Provide compression lugs where indicated.

- N. Enclosures:
1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
    - b. Outdoor Locations: Type 3R.
  2. Finish: Manufacturer's standard unless otherwise indicated.
- O. Future Provisions:
1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
  2. Equip distribution sections with full height vertical bussing to accommodate maximum utilization of space for devices.
  3. Where designated spaces for future device provisions are not indicated, include provisions for minimum of 4 device(s) rated at 225 amperes.
  4. Arrange and equip through bus and ground bus to accommodate future installation of additional switchboard sections.
- P. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 43 00, list switchboards as a complete assembly including surge protective device.
- Q. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
1. Where overcurrent protective devices equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
  2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
    - a. Use zero sequence or residual ground fault detection method unless otherwise indicated.
    - b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
    - c. Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control ground fault delay functions for system coordination purposes.
- R. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.
- S. Owner Metering:
1. Provide microprocessor-based digital electrical metering system including all instrument transformers, wiring, and connections necessary for measurements specified.

2. Measured Parameters:
    - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
    - b. Current (Amps): For each phase and neutral.
    - c. Frequency (Hz).
    - d. Real power (kW): For each phase, 3-phase total.
    - e. Reactive power (kVAR): For each phase, 3-phase total.
    - f. Apparent power (kVA): For each phase, 3-phase total.
    - g. Power factor.
    - h. Real energy (kWh).
  3. Meter Accuracy: Plus/minus 1.0 percent.
  4. Features:
    - a. Communications Capability: Compatible with system indicated.  
Provide all accessories necessary for proper interface.
- T. Instrument Transformers:
1. Comply with IEEE C57.13.
  2. Select suitable ratio, burden, and accuracy as required for connected devices.
  3. Current Transformers: Connect secondaries to shorting terminal blocks.
  4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

## 2.3 OVERCURRENT PROTECTIVE DEVICES

- A. Circuit Breakers:
1. Interrupting Capacity:
    - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
    - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
  2. Molded Case Circuit Breakers:
    - a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
      - 1) Provide thermal magnetic circuit breakers unless otherwise indicated.
      - 2) Provide electronic trip circuit breakers where indicated.
    - b. Minimum Interrupting Capacity:
      - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      - 2) 14,000 rms symmetrical amperes at 480 VAC.
    - c. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

- 1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
- 2) Provide interchangeable trip units where indicated.
- d. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
  - 1) Provide the following field-adjustable trip response settings:
    - (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
    - (b) Long time delay.
    - (c) Short time pickup and delay.
    - (d) Instantaneous pickup.
    - (e) Ground fault pickup and delay where ground fault protection is indicated.
  - 2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
- e. Provide the following circuit breaker types where indicated:
  - 1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.
  - 2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
- f. Provide the following features and accessories where indicated or where required to complete installation:
  - 1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
  - 2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.

## 2.4 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
  1. Dielectric tests.
  2. Mechanical operation tests.
  3. Grounding of instrument transformer cases test.
  4. Electrical operation and control wiring tests, including polarity and sequence tests.
  5. Ground-fault sensing equipment test.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive switchboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

### **3.2 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
- C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
- D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Provide required seismic controls in accordance with Section 26 05 48.
- G. Install switchboards plumb and level.
- H. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00.
- I. Provide grounding and bonding in accordance with Section 26 05 26.
- J. Install all field-installed devices, components, and accessories.
- K. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- L. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 26 05 73.
- M. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- N. Provide filler plates to cover unused spaces in switchboards.
- O. Identify switchboards in accordance with Section 26 05 53.

### **3.3 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.

- C. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
- D. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.
- E. Inspect and test in accordance with NETA ATS, except Section 4.
- F. Perform inspections and tests listed in NETA ATS, Section 7.1.
- G. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than \_\_\_\_\_ amperes. Tests listed as optional are not required.
- H. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
  - 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
- I. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.
- J. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.
- K. Test shunt trips to verify proper operation.
- L. Correct deficiencies and replace damaged or defective switchboards or associated components.
- M. Submit detailed reports indicating inspection and testing results and corrective actions taken.

### **3.4 ADJUSTING**

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of switchboard covers and doors.

### **3.5 CLEANING**

- A. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred surfaces to match original factory finish.

### **3.6 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchboard and associated devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Manufacturer's authorized representative.
4. Location: At project site.

### **3.7 PROTECTION**

- A. Protect installed switchboards from subsequent construction operations.

## **SECTION 26 24 16 PANELBOARDS**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
  - 1. Includes requirements for the seismic qualification of equipment specified in this section.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
- G. Section 26 22 00 - Low-Voltage Transformers: Small power centers with integral primary breaker, transformer, and panelboard.

#### **1.3 REFERENCE STANDARDS**

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.
- D. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- E. NEMA PB 1 - Panelboards; 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000 Volts or Less; 2023.
- G. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.



- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- K. UL 67 - Panelboards; Current Edition, Including All Revisions.
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- M. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.
- N. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
- O. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
  - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  - 5. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
  - 1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  - 1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
  - 2. Include wiring diagrams showing all factory and field connections.
  - 3. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.

- E. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.
- F. Field Quality Control Test Reports.
- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- H. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Panelboard Keys: Two of each different key.

#### **1.6 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

#### **1.8 FIELD CONDITIONS**

- A. Maintain ambient temperature within the following limits during and after installation of panelboards:
  - 1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

### **PART 2 PRODUCTS**

## **2.1 MANUFACTURERS**

- A. ABB: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
- B. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
- C. Schneider Electric: [www.se.com/#sle](http://www.se.com/#sle).
- D. Siemens Industry, Inc: [www.new.siemens.com/#sle](http://www.new.siemens.com/#sle).
- E. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Source Limitations: Provide panelboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from a single supplier.

## **2.2 PANELBOARDS - GENERAL REQUIREMENTS**

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Seismic Qualification: Provide panelboards and associated components suitable for application under the seismic design criteria specified in Section 26 05 48 where required. Include certification of compliance with submittals.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet.
  - 2. Ambient Temperature:
    - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- D. Short Circuit Current Rating:
  - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
  - 2. Listed series ratings are not acceptable.
- E. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- F. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- G. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- H. Bussing: Sized in accordance with UL 67 temperature rise requirements.
  - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
  - 2. Provide 200 percent rated neutral bus and lugs where indicated, where oversized neutral conductors are provided, or where panelboards are fed from K-rated transformers.

3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
  4. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.
- I. Conductor Terminations: Suitable for use with the conductors to be installed.
- J. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
  2. Boxes: Galvanized steel unless otherwise indicated.
    - a. Provide wiring gutters sized to accommodate the conductors to be installed.
    - b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
    - c. Provide removable end walls for NEMA Type 1 enclosures.
    - d. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
  3. Fronts:
    - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
    - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
    - c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
  4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- K. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- L. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.
1. Ampere Rating: Not less than ampere rating of panelboard bus.
  2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
  3. Coil Voltage: As required for connection to control system indicated.
- M. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.

- N. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- O. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.
- P. Provide the following features and accessories where indicated or where required to complete installation:
  - 1. Feed-through lugs.
  - 2. Sub-feed lugs.

## **2.3 POWER DISTRIBUTION PANELBOARDS**

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
  - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
  - 1. Phase and Neutral Bus Material: Copper.
  - 2. Ground Bus Material: Copper.
- D. Circuit Breakers:
  - 1. Provide bolt-on type.
  - 2. Provide thermal magnetic circuit breakers unless otherwise indicated.
  - 3. Provide electronic trip circuit breakers where indicated.
- E. Enclosures:
  - 1. Provide surface-mounted or flush-mounted enclosures unless otherwise indicated.
  - 2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  - 3. Provide clear plastic circuit directory holder mounted on inside of door.

## **2.4 LIGHTING AND APPLIANCE PANELBOARDS**

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
  - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:

1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Copper.
3. Ground Bus Material: Copper.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
  1. Provide surface-mounted or flush-mounted enclosures as indicated.
  2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  3. Provide clear plastic circuit directory holder mounted on inside of door.
- F. Provide column-width panelboards with accessory column-width cable trough and pullbox where indicated.

## **2.5 OVERCURRENT PROTECTIVE DEVICES**

- A. Molded Case Circuit Breakers:
  1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
  2. Interrupting Capacity:
    - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      - 2) 14,000 rms symmetrical amperes at 480 VAC.
    - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
  3. Conductor Terminations:
    - a. Provide mechanical lugs unless otherwise indicated.
    - b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
    - a. Provide interchangeable trip units where indicated.
  5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
    - a. Provide the following field-adjustable trip response settings:
      - 1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
      - 2) Long time delay.
      - 3) Short time pickup and delay.
      - 4) Instantaneous pickup.

- 5) Ground fault pickup and delay where ground fault protection is indicated.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
  - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
8. Do not use tandem circuit breakers.
9. Do not use handle ties in lieu of multi-pole circuit breakers.
10. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
11. Provide the following features and accessories where indicated or where required to complete installation:
  - a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
  - b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

## **2.6 SOURCE QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Factory test panelboards according to NEMA PB 1.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

### **3.2 INSTALLATION**

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Provide required seismic controls in accordance with Section 26 05 48.
- G. Install panelboards plumb.
- H. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

- I. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- J. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.
- K. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- L. Provide grounding and bonding in accordance with Section 26 05 26.
  - 1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
  - 2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.
- M. Install all field-installed branch devices, components, and accessories.
- N. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- O. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- P. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73.
- Q. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- R. Provide filler plates to cover unused spaces in panelboards.
- S. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
  - 1. Emergency and night lighting circuits.
  - 2. Fire detection and alarm circuits.
  - 3. Communications equipment circuits.
  - 4. Intrusion detection and access control system circuits.
  - 5. Video surveillance system circuits.
- T. Identify panelboards in accordance with Section 26 05 53.

### **3.3 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.



1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
- D. Test GFCI circuit breakers to verify proper operation.
- E. Test AFCI circuit breakers to verify proper operation.
- F. Test shunt trips to verify proper operation.
- G. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.
- H. Correct deficiencies and replace damaged or defective panelboards or associated components.

### **3.4 ADJUSTING**

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

### **3.5 CLEANING**

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

## **SECTION 26 27 13 ELECTRICITY METERING**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Equipment for Owner electricity metering:

#### **1.2 RELATED REQUIREMENTS**

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 33.16 - Boxes for Electrical Systems: Cabinets and enclosures for metering system components.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 21 00 - Low-Voltage Electrical Service Entrance: Requirements for Utility Company electricity metering.
- F. Section 26 23 00 - Low-Voltage Switchgear: For interface with meters specified in this section.
- G. Section 26 24 13 - Switchboards: For interface with meters specified in this section.
- H. Section 26 24 16 - Panelboards: For interface with meters specified in this section.
- I. Section 26 24 19 - Motor-Control Centers: For interface with meters specified in this section.
- J. Section 26 28 13 - Fuses.
  - 1. Includes requirements for spare fuses and spare fuse cabinets.
- K. Section 27 10 00 - Structured Cabling: Data cables for IP network connections.

#### **1.3 REFERENCE STANDARDS**

- A. ANSI C12.1 - Electric Meters - Code for Electricity Metering; 2024.
- B. ANSI C12.20 - American National Standard for Electricity Meters - 0.1, 0.2, and 0.5 Accuracy Classes; 2022.
- C. IEC 62053-21 - Electricity Metering Equipment - Particular Requirements - Part 21: Static Meters for AC Active Energy (Classes 0,5, 1 and 2); 2020.
- D. IEC 62053-22 - Electricity Metering Equipment - Particular Requirements - Part 22: Static Meters for AC Active Energy (Classes 0,1S,0,2S and 0,5S); 2020.
- E. IEC 62053-23 - Electricity Metering Equipment - Particular Requirements - Part 23: Static Meters for Reactive Energy (Classes 2 and 3); 2020.
- F. IEEE 1459 - IEEE Standard Definitions for the Measurement of Electric Power Quantities Under Sinusoidal, Nonsinusoidal, Balanced, or Unbalanced Conditions; 2025, with Errata.

- G. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.
- H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- I. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- J. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.
- K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate work to provide equipment suitable for interface with electricity metering systems to be provided.
  - 2. Coordinate the work with other installers to provide communication lines required for electricity metering system interface.
  - 3. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Preinstallation Meeting: Conduct meeting with facility representative and other related equipment manufacturers to discuss electricity metering system interface requirements.

#### **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for electricity metering systems and associated components and accessories. Include ratings, configurations, standard wiring diagrams, dimensions, service condition requirements, and installed features.
- C. Shop Drawings: Include system interconnection schematic diagrams showing all factory and field connections. Include requirements for interface with other systems.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Field Quality Control Test Reports.
- F. Project Record Documents: Record actual installed locations of meters and final equipment settings.
- G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Enclosure Keys: Two of each different key.
3. See Section 26 28 13 for requirements for spare fuses and spare fuse cabinets.

## **1.6 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

## **1.8 FIELD CONDITIONS**

- A. Maintain field conditions within required service conditions during and after installation.

# **PART 2 PRODUCTS**

## **2.1 MANUFACTURERS**

- A. Electricity Meters:
  1. ABB: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
  2. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
  3. Schneider Electric: [www.se.com/#sle](http://www.se.com/#sle).
  4. Siemens Industry, Inc: [www.new.siemens.com/#sle](http://www.new.siemens.com/#sle).
  5. SOCOMEC: [www.socomec.us/#sle](http://www.socomec.us/#sle).
  6. Veris Industries: [www.veris.com/#sle](http://www.veris.com/#sle).
  7. Substitutions: See Section 01 60 00 - Product Requirements.
  8. Source Limitations: Provide electricity meters produced by single manufacturer and obtained from single supplier.

## **2.2 EQUIPMENT FOR OWNER ELECTRICITY METERING**

- A. Provide microprocessor-based digital electricity metering systems including all instrument transformers, wiring, and connections necessary for measurements specified.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.

- C. Provide electricity metering systems and associated components compatible with the equipment and associated circuits to be metered.
- D. Service Conditions: Provide electricity meters suitable for operation under the service conditions at the installed location.
- E. Enclosures:
  - 1. Where not furnished by manufacturer, provide required cabinets and enclosures in accordance with Section 26 05 33.16.
  - 2. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R or Type 4.
  - 3. Provide lockable door(s) for outdoor locations.
  - 4. Finish: Manufacturer's standard unless otherwise indicated.
- F. Instrument Transformers:
  - 1. Comply with IEEE C57.13, where applicable.
  - 2. Select suitable ratio, burden, and accuracy as required for connected devices.
  - 3. Current Transformers: Compatible with connected meters; replace meters damaged by connection of incompatible current transformers. Provide shorting terminal blocks for connection of secondaries where applicable.
  - 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.
- G. Accessories:
  - 1. Wiring: Provide manufacturer's recommended cables as indicated or as required for connections between system components.
  - 2. IP Network Connections:
    - a. Unless otherwise indicated, network switches required for network connections to system components provided by Contractor.
    - b. Unless otherwise indicated, network cables required for network connections to system components provided by Contractor.
      - 1) Network Cables: Unshielded twisted pair (UTP), minimum Category 5e.
      - 2) See Section 27 10 00.
  - 3. Provide wireless communication transceivers as indicated or as required for network connections to wired devices using supported protocols.
    - a. Products:
      - 1) SOCOMEC; RF HUB-Node/END-Node Wireless System: [www.socomec.us/#sle](http://www.socomec.us/#sle).
      - 2) Substitutions: See Section 01 60 00 - Product Requirements.
- H. Interface with Other Work:
  - 1. Interface with electrical power monitoring system as specified on drawings.

2. Interface with building automation system as specified on drawings.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of metering systems and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive meters.
- D. Verify that conditions are satisfactory for installation prior to starting work.

#### **3.2 INSTALLATION**

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Provide required support and attachment components in accordance with Section 26 05 29.
- D. Provide grounding and bonding in accordance with Section 26 05 26.
- E. Provide fuses complying with Section 26 28 13 as required.
- F. Identify meters and associated wiring in accordance with Section 26 05 53.

#### **3.3 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.
- D. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.
- E. Correct deficiencies and replace damaged or defective metering system components.
- F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

#### **3.4 ADJUSTING**

- A. Program system parameters according to requirements of Owner.

#### **3.5 CLEANING**

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

#### **3.6 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

- C. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of two hours of training.
  - 3. Instructor: Manufacturer's authorized representative.
  - 4. Location: At project site.

### **3.7 PROTECTION**

- A. Protect installed system components from subsequent construction operations.

## **SECTION 26 27 26 WIRING DEVICES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
- D. Wall plates and covers.
- E. Floor box service fittings.
- F. Access floor boxes.
- G. Power pedestals.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 09 69 00 - Access Flooring.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- D. Section 26 05 33.16 - Boxes for Electrical Systems.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 05 83 - Wiring Connections: Cords and plugs for equipment.
- G. Section 26 09 23 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.
- H. Section 27 10 00 - Structured Cabling: Voice and data jacks.

#### **1.3 REFERENCE STANDARDS**

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g (Validated 2023).
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
- E. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- F. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).



- G. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
- J. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- K. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- L. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
- M. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.
- N. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
  - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
  - 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
  - 4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
  - 5. Notify LP Consulting Engineers, Inc. of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
  - 1. Do not install wiring devices until final surface finishes and painting are complete.

#### **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
  - 1. Wall Dimmers: Include derating information for ganged multiple devices.
- C. Samples: One for each type and color of device and wall plate specified.
- D. Field Quality Control Test Reports.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

- F. Operation and Maintenance Data:
  - 1. Wall Dimmers: Include information on operation and setting of presets.
  - 2. GFCI Receptacles: Include information on status indicators.
- G. Project Record Documents: Record actual installed locations of wiring devices.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
  - 3. Extra Keys for Locking Switches: Two of each type.
  - 4. Extra Wall Plates: One of each style, size, and finish.
  - 5. Extra Flush Floor Service Fittings: Two of each type.

## **1.6 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Products: Listed, classified, and labeled as suitable for the purpose intended.
- E. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratories (NRTL), and acceptable to authorities having jurisdiction.

## **1.7 DELIVERY, STORAGE, AND PROTECTION**

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

# **PART 2 PRODUCTS**

## **2.1 WIRING DEVICES - GENERAL REQUIREMENTS**

- A. Provide wiring devices suitable for intended use with ratings adequate for load served.
- B. Except where explicitly permitted, substitution of combination switch-and-receptacle devices for separate switches and receptacles is not permitted.
- C. Prewired Wiring Device and Outlet Box Assemblies: Factory-assembled products complying with requirements for wiring devices, boxes, and wiring methods may be used in lieu of field-assembled products.
  - 1. Wiring: See Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
  - 2. Boxes: See Section 26 05 33.16 - Boxes for Electrical Systems.
- D. Wiring Device Applications:

1. Receptacles Installed Outdoors or in Damp or Wet Locations: Use weather-resistant GFCI receptacles with weatherproof covers.
  2. Receptacles Installed in Dwelling Units: Use tamper-resistant receptacles.
  3. Provide GFCI protection for:
    - a. Receptacles installed within 6 feet of sinks.
    - b. Receptacles installed in kitchens.
    - c. Receptacles serving electric drinking fountains.
  4. Single Receptacles Installed on Individual Branch Circuits: Provide receptacle ampere rating equal to branch circuit rating.
  5. Flush Floor Service Fittings in Tile Floors: Use tile rings.
  6. Flush Floor Service Fittings in Carpeted Floors: Use carpet flanges.
- E. Wiring Device Finishes:
1. Provide wiring device finishes as described below, unless otherwise indicated.
  2. Wiring Devices, Unless Otherwise Indicated: White with white nylon wall plate.
  3. Wiring Devices Installed in Finished Spaces: White with white nylon wall plate.
  4. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.
  5. Wiring Devices Installed in Wet or Damp Locations: White with weatherproof cover.

## **2.2 WALL SWITCHES**

- A. General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
- C. Locking Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever type keyed switch actuator and maintained contacts; switches keyed alike; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

## **2.3 WALL DIMMERS**

- A. General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without

removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

- B. Control: Slide control type with separate on/off switch.
- C. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:
- D. Provide locator light, illuminated with load off.
- E. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

## **2.4 RECEPTACLES**

- A. General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
  - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
  - 2. NEMA configurations specified are according to NEMA WD 6.
  - 3. Hospital Grade Receptacles: Listed as complying with UL 498 Supplement SD, with green dot hospital grade mark on device face.
- B. Convenience Receptacles:
  - 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
  - 2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
  - 3. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
  - 4. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
  - 5. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
- C. GFCI Receptacles:
  - 1. General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
    - a. Provide test and reset buttons of same color as device.

2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
  3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
  4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
  5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
- D. USB Charging Devices:
1. General Requirements: Listed as complying with UL 1310.
    - a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
    - b. Charging Capacity - Four-Port Devices: 4.2 A, minimum.
  2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.
  3. USB Charging Noncombination Devices: Four-port (Type A); rectangular decorator style.
- E. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.
1. Standard Locking Convenience Receptacles: Single, 20A, 125V, NEMA L5-20R.
- F. Clock Hanger Receptacles: Single, 15A, 125V, NEMA 5-15R.

## **2.5 WALL PLATES AND COVERS**

- A. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
  2. Size: Standard; \_\_\_\_\_.
  3. Screws: Metal with slotted heads finished to match wall plate finish.
  4. Provide screwless wallplates with concealed mounting hardware where indicated.
- B. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- D. Brass Wall Plates: Brushed satin finish, factory-coated to inhibit oxidation.
- E. Aluminum Wall Plates: Smooth satin finish, clear anodized, factory-coated to inhibit oxidation.

- F. Chrome Wall Plates: Smooth finish, chrome plated steel.
- G. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- H. Premarked Wall Plates: Factory labeled as indicated; hot stamped for nylon wall plates and engraved for metal wall plates.
- I. Weatherproof Receptacle Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.
- J. Weatherproof Receptacle Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.
- K. Weatherproof Switch Covers for Wet or Damp Locations: Gasketed, metallic, with externally operable actuating means and corrosion-resistant screws; listed as suitable for use in wet locations.
  - 1. \_\_\_\_\_ Wall Plates: \_\_\_\_\_.

## **2.6 FLOOR BOX SERVICE FITTINGS**

- A. Description: Service fittings compatible with floor boxes provided under Section 26 05 33.16 with components, adapters, and trims required for complete installation.
- B. Above-Floor Service Fittings:
  - 1. Single Service Pedestal Convenience Receptacles:
    - a. Configuration: One standard convenience duplex receptacle.
  - 2. Single Service Pedestal Communications Outlets:
    - a. Configuration: One 1 inch bushed opening.
    - b. Voice and Data Jacks: As specified in Section 27 10 00.
  - 3. Single Service Pedestal Furniture Feed:
    - a. Configuration: One 3/4 inch knockout.
  - 4. Dual Service Pedestal Combination Outlets:
    - a. Configuration:
      - 1) Power: One standard convenience duplex receptacle.
      - 2) Communications: One 1 inch bushed opening.
      - 3) Voice and Data Jacks: As specified in Section 27 10 00.
    - b. Provide barrier to separate line and low voltage compartments.
- C. Flush Floor Service Fittings:
  - 1. Single Service Flush Convenience Receptacles:
    - a. Cover: Rectangular.
    - b. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).
  - 2. Single Service Flush Communications Outlets:
    - a. Cover: Rectangular.

- b. Configuration: \_\_\_\_\_.
  - c. Voice and Data Jacks: As specified in Section 27 10 00.
- 3. Single Service Flush Furniture Feed:
  - a. Cover: Rectangular.
  - b. Configuration: One 2-1/8 inch by 3/4 inch combination threaded opening(s).
- 4. Dual Service Flush Combination Outlets:
  - a. Cover: Rectangular.
  - b. Configuration:
    - 1) Power: One standard convenience duplex receptacle(s) with duplex flap opening(s).
    - 2) Voice and Data Jacks: As specified in Section 27 10 00.
- 5. Dual Service Flush Furniture Feed:
  - a. Cover: Rectangular.
  - b. Configuration:
    - 1) Power: One 2-1/8 inch by 3/4 inch combination threaded opening(s).
    - 2) Communications: One 2-1/8 inch by 1 inch combination threaded opening(s).
- 6. Accessories:
  - a. Tile Rings: Finish to match covers; configuration as required to accommodate specified covers.
  - b. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

## **2.7 ACCESS FLOOR BOXES**

- A. Description: Metallic multi-service box suitable for mounting in access floor system specified in Section 09 69 00.
- B. Access floor boxes with pre-wired connectors for manufactured wiring systems are permitted only where manufactured wiring systems are permitted as specified in Section 26 05 19.
- C. Configuration:
  - 1. Power: Two standard convenience duplex receptacle(s) unless noted otherwise on drawings.
  - 2. Voice and Data Jacks: As specified in Section 27 10 00.

## **2.8 POWER PEDESTALS**

- A. Description: Listed pedestal enclosures with provisions for wiring devices.
- B. Construction: Steel with corrosion-resistant finish.
- C. Outdoor Power Pedestals: NEMA EN 10250, Type 3R.
- D. Power Pedestal Configuration:
  - 1. Wiring Devices: One 20 A weather- and tamper-resistant GFCI duplex receptacle.

2. Wiring Device Access: Provide hinged cover; lockable.
3. Mounting Provisions: Designed for surface mounting (hardscaped areas or concrete base in landscaped areas).

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that floor boxes are adjusted properly.
- F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- G. Verify that core drilled holes for poke-through assemblies are in proper locations.
- H. Verify that openings in access floor are in proper locations.
- I. Verify that conditions are satisfactory for installation prior to starting work.

### **3.2 PREPARATION**

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

### **3.3 INSTALLATION**

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of wiring devices provided under this section.
  1. Mounting Heights: Unless otherwise indicated, as follows:
    - a. Wall Switches: 48 inches above finished floor.
    - b. Wall Dimmers: 48 inches above finished floor.
    - c. Receptacles: 18 inches above finished floor or 6 inches above counter.
    - d. \_\_\_\_\_.
  2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
  3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.



4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify LP Consulting Engineers, Inc. to obtain direction prior to proceeding with work.
  5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- C. Install wiring devices in accordance with manufacturer's instructions.
  - D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
  - E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
  - F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
  - G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
  - H. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.
  - I. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
  - J. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.
  - K. Install wiring devices plumb and level with mounting yoke held rigidly in place.
  - L. Install wall switches with OFF position down.
  - M. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
  - N. Do not share neutral conductor on branch circuits utilizing wall dimmers.
  - O. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
  - P. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
  - Q. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
  - R. Identify wiring devices in accordance with Section 26 05 53.

### **3.4 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect each wiring device for damage and defects.
- C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- D. Test each receptacle to verify operation and proper polarity.
- E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- F. Correct wiring deficiencies and replace damaged or defective wiring devices.

### **3.5 ADJUSTING**

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by LP Consulting Engineers, Inc..

### **3.6 CLEANING**

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

## **SECTION 26 28 13 FUSES**

### **PART 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Fuses.
- B. Spare fuse cabinet.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- B. Section 26 05 73 - Power System Studies: Additional criteria for the selection of protective devices specified in this section.
- C. Section 26 28 16.16 - Enclosed Switches: Fusible switches.
- D. Section 26 31 00 - Photovoltaic Collectors: Additional requirements for photovoltaic fuses.

#### **1.3 REFERENCE STANDARDS**

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.
- D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.
- E. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses; Current Edition, Including All Revisions.
- F. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.
- G. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.
- H. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses; Current Edition, Including All Revisions.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
    - a. Fusible Enclosed Switches: See Section 26 28 16.16.
  - 2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.

3. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

## **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
  1. Spare Fuse Cabinet: Include dimensions.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Extra Fuses: Three set(s) of three for each type and size installed.
  3. Fuse Pullers: One set(s) compatible with each type and size installed.
  4. Spare Fuse Cabinet Keys: Two.

## **1.6 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Bussmann, a division of Eaton Corporation; \_\_\_\_\_: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
- B. Littelfuse, Inc; \_\_\_\_\_: [www.littelfuse.com/#sle](http://www.littelfuse.com/#sle).
- C. Mersen; \_\_\_\_\_: [ep-us.mersen.com/#sle](http://ep-us.mersen.com/#sle).
- D. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.2 APPLICATIONS**

- A. Service Entrance:
  1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
  2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- B. Feeders:
  1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
  2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- C. General Purpose Branch Circuits: Class RK1, time-delay.
- D. Individual Motor Branch Circuits: Class RK1, time-delay.

- E. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.
- F. Primary Protection for Control Transformers: Class CC, time-delay.

## **2.3 FUSES**

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.
  - 1. Class RK1, Time-Delay Fuses:
- H. Class J Fuses: Comply with UL 248-8.
  - 1. Class J, Time-Delay Fuses:
- I. Class L Fuses: Comply with UL 248-10.
  - 1. Class L, Time-Delay Fuses:
- J. Class T Fuses: Comply with UL 248-15.
- K. Class CC Fuses: Comply with UL 248-4.
  - 1. Class CC, Time-Delay Fuses:
- L. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- M. Provide the following accessories where indicated or where required to complete installation:
  - 1. Fuseholders: Compatible with indicated fuses.
  - 2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

## **2.4 SPARE FUSE CABINET**

- A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.
- B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

- B. Verify that mounting surfaces are ready to receive spare fuse cabinet.
- C. Verify that conditions are satisfactory for installation prior to starting work.

### **3.2 INSTALLATION**

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.
- C. Install spare fuse cabinet where indicated.
- D. Identify spare fuse cabinet in accordance with Section 26 05 53.

**SECTION 26 28 16.16  
ENCLOSED SWITCHES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Enclosed safety switches.

**1.2 RELATED REQUIREMENTS**

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
  - 1. Includes requirements for the seismic qualification of equipment specified in this section.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 05 73 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.
- F. Section 26 28 13 - Fuses.

**1.3 REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- C. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).
- D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.
- I. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated

- equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  4. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

## **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
  2. Include wiring diagrams showing all factory and field connections.
  3. Identify mounting conditions required for equipment seismic qualification.
- D. Manufacturer's equipment seismic qualification certification.
- E. Field Quality Control Test Reports.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- G. Project Record Documents: Record actual locations of enclosed switches.
- H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. See Section 26 28 13 for requirements for spare fuses and spare fuse cabinets.

## **1.6 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.



- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

## **1.8 FIELD CONDITIONS**

- A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

# **PART 2 PRODUCTS**

## **2.1 MANUFACTURERS**

- A. ABB: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
- B. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
- C. Schneider Electric: [www.se.com/#sle](http://www.se.com/#sle).
- D. Siemens Industry, Inc: [www.new.siemens.com/#sle](http://www.new.siemens.com/#sle).
- E. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Source Limitations: Provide enclosed switches and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

## **2.2 ENCLOSED SAFETY SWITCHES**

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Seismic Qualification: Provide enclosed safety switches suitable for application under the seismic design criteria specified in Section 26 05 48 where required. Include certification of compliance with submittals.
- D. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet.
  - 2. Ambient Temperature: Between -22 degrees F and 104 degrees F.
- E. Horsepower Rating: Suitable for connected load.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Short Circuit Current Rating:

1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
2. Minimum Ratings:
  - a. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
  - b. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.
- H. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- I. Provide with switch blade contact position that is visible when the cover is open.
- J. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
  1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
- K. Conductor Terminations: Suitable for use with the conductors to be installed.
- L. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
- M. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- N. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
  1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
  2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
- O. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- P. Heavy Duty Switches:
  1. Comply with NEMA BS 31047.
  2. Conductor Terminations:
    - a. Provide mechanical lugs unless otherwise indicated.
    - b. Provide compression lugs where indicated.
    - c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

- a. Provide means for locking handle in the ON position where indicated.
- Q. Provide the following features and accessories where indicated or where required to complete installation:
  - 1. Hubs: As required for environment type; sized to accept conduits to be installed.
  - 2. Integral fuse pullers.
  - 3. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.
  - 4. Viewing Window: Positioned over switch blades for visual confirmation of contact position with door closed.
  - 5. Interlocked Receptacle: Integral pre-wired three phase, three wire, grounded type receptacle interlocked with switch mechanism to prevent insertion or removal of plug with switch in the ON position and to prevent switch from being placed in the ON position without matching plug inserted. Provide receptacle configuration as required to accept plug as indicated on the drawings.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.
- D. Verify that conditions are satisfactory for installation prior to starting work.

#### **3.2 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 26 05 29.
- E. Provide required seismic controls in accordance with Section 26 05 48.
- F. Install enclosed switches plumb.
- G. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- H. Provide grounding and bonding in accordance with Section 26 05 26.
- I. Provide fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Identify enclosed switches in accordance with Section 26 05 53.

### **3.3 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

### **3.4 ADJUSTING**

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

### **3.5 CLEANING**

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

**SECTION 26 31 00  
PHOTOVOLTAIC COLLECTORS**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Photovoltaic system requirements.
- B. Photovoltaic modules.
- C. Photovoltaic module mounting system.
- D. Photovoltaic combiner boxes.
- E. Photovoltaic inverters.
- F. Charge controllers.
- G. Monitoring system.

**1.2 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Materials and installation requirements for concrete foundations.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- D. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- E. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 21 00 - Low-Voltage Electrical Service Entrance.
- H. Section 26 22 00 - Low-Voltage Transformers: Isolation transformers not integral to inverters.
- I. Section 26 28 13 - Fuses.
- J. Section 26 28 16.16 - Enclosed Switches.
- K. Section 26 43 00 - Surge Protective Devices.

**1.3 REFERENCE STANDARDS**

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. IEC 61215-1 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1: Test Requirements; 2021, with Corrigendum.
- C. IEC 61215-1-1 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1-1: Special Requirements for Testing of Crystalline Silicon Photovoltaic (PV) Modules; 2021.

- D. IEC 61215-1-2 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1-2: Special Requirements for Testing of Thin-Film Cadmium Telluride (CdTe) Based Photovoltaic (PV) Modules; 2021, with Amendment (2022).
- E. IEC 61215-1-3 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1-3: Special Requirements for Testing of Thin-Film Amorphous Silicon Based Photovoltaic (PV) Modules; 2021, with Amendment (2022).
- F. IEC 61215-1-4 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1-4: Special Requirements for Testing of Thin-Film Cu(In,Ga)(S,Se)<sub>2</sub> Based Photovoltaic (PV) Modules; 2021, with Amendment (2022).
- G. IEC 61215-2 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 2: Test Procedures; 2021.
- H. IEEE 1547 - IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces; 2018, with Amendment (2020).
- I. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- J. NECA 412 - Standard for Installing and Maintaining Photovoltaic (PV) Power Systems; 2012.
- K. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. UL 489B - Outline of Investigation for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures for Use with Photovoltaic (PV) Systems; Current Edition, Including All Revisions.
- N. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.
- O. UL 1699B - Outline of Investigation for Photovoltaic (PV) DC Arc-Fault Circuit Protection; Current Edition; Current Edition, Including All Revisions.
- P. UL 1703 - Flat Plate Photovoltaic Modules and Panels; Current Edition, Including All Revisions.
- Q. UL 1741 - Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources; Current Edition, Including All Revisions.
- R. UL 2579 - Low-Voltage Fuses - Fuses for Photovoltaic Systems; Current Edition, Including All Revisions.
- S. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

## **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for photovoltaic system components.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Roof-Mounted Arrays: Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
  - 4. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Preinstallation Meeting: Convene one week prior to commencing work of this section; require attendance of all affected installers. Include adequate instruction on the electrical hazards associated with photovoltaic systems and appropriate safety procedures to be followed.
- C. Rebates and Incentives: Prepare and submit documentation as required for Owner to secure funds from available federal, state, and utility company rebate and incentive programs. Notify Owner of any time constraints affecting program qualification.
  - 1. Include copies of documentation with submittals.
- D. Utility Interconnection:
  - 1. See Section 26 21 00 for Utility Company contact information and additional requirements.
  - 2. Prepare and submit documentation as required for securing utility interconnection agreement between Owner and Utility Company.
    - a. Include copies of documentation with submittals.
  - 3. Preinstallation Meeting: Convene one week prior to commencing work of this section to review interconnection requirements and details with Utility Company representative.
  - 4. Coordinate with Utility Company to provide utility metering suitable for system requirements.
  - 5. Arrange for inspections and secure permits necessary to obtain Utility Company approval of system.

## **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.
- C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, attachment locations and

details, and proposed size, type, and routing of conduits and cables. Include system interconnection schematic diagrams showing all factory and field connections.

1. Include proposed locations of roof penetrations and proposed methods for sealing.
- D. Design Data:
1. Include structural calculations, certified by structural engineer, for equipment and mounting system.
  2. Include electrical calculations for array and associated equipment other than the basis of design products and configuration.
- E. Certify that products of this section meet or exceed specified requirements.
- F. Certify that work of this section does not void roof warranty.
- G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.
- H. Manufacturer's detailed field testing procedures.
- I. Manufacturer's detailed startup procedures.
- J. Rebate and incentive documentation.
- K. Utility interconnection documentation.
- L. Source quality control test reports.
- M. Field quality control test reports.
1. Include manufacturer's field reports.
- N. Structural Designer's Qualification Statement.
- O. Electrical Designer's Qualification Statement.
- P. Manufacturer's Qualification Statement.
- Q. Installer's Qualification Statement.
- R. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- S. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- T. Maintenance contracts.
- U. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.
- V. Software: One copy of software provided under this section.



- W. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Extra Photovoltaic Modules: Two.

## **1.6 QUALITY ASSURANCE**

- A. Comply with NFPA 70.
- B. Comply with Utility Company requirements for interconnection.
- C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- D. Structural Designer Qualifications: Registered structural engineer licensed in California.
- E. Electrical Designer Qualifications: Registered electrical engineer licensed in California experienced in the design of photovoltaic systems.
- F. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- G. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience with photovoltaic systems of similar size, type, and complexity.
1. Licensed in California to install photovoltaic systems.
  2. Manufacturer's authorized installer.
  3. Supervisor: North American Board of Certified Energy Practitioners (NABCEP) certified PV Installer or three years experience supervising the installation of photovoltaic systems.
  4. Installer Personnel: At least 2 years of experience installing photovoltaic systems.
- H. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
1. Contract maintenance office located within 50 miles of project site.
- I. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

## **1.8 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

- B. Specified warranties indicate minimum requirements. Provide additional warranties or extended warranty periods where required to qualify for rebate and incentive programs.
- C. Photovoltaic Modules:
  - 1. Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.
  - 2. Provide manufacturer warranty guaranteeing minimum 90 percent of rated power output for 10 years and minimum 80 percent of rated power output for 20 years.
- D. Photovoltaic Module Mounting System: Provide minimum 10 year manufacturer warranty covering repair or replacement due to defective materials or workmanship.
- E. Photovoltaic Combiner Boxes: Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.
- F. Photovoltaic Inverters: Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Photovoltaic Modules, Crystalline Silicon:
  - 1. Kyocera Solar, Inc; \_\_\_\_\_: [www.kyocerasolar.com/#sle](http://www.kyocerasolar.com/#sle).
  - 2. SolarWorld Americas; \_\_\_\_\_: [www.solarworld-usa.com/#sle](http://www.solarworld-usa.com/#sle).
  - 3. Qcells: [www.qcells.com/us](http://www.qcells.com/us)
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Photovoltaic Modules, Thin Film:
  - 1. First Solar; \_\_\_\_\_: [www.firstsolar.com/#sle](http://www.firstsolar.com/#sle).
  - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Photovoltaic Module Mounting System:
  - 1. Cooper B-Line, a division of Cooper Industries; \_\_\_\_\_: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
  - 2. Direct Power and Water Corporation; \_\_\_\_\_: [www.dpwsolar.com/#sle](http://www.dpwsolar.com/#sle).
  - 3. Metal Roof Innovations, Ltd. S-5! Attachment Solutions; S-5! PV Kit: [www.s-5.com/#sle](http://www.s-5.com/#sle).
  - 4. PHP Systems/Design; \_\_\_\_\_: [www.phpsd.com/#sle](http://www.phpsd.com/#sle).
  - 5. TRA Snow and Sun; \_\_\_\_\_: [www.trasnowandsun.com/#sle](http://www.trasnowandsun.com/#sle).
  - 6. Unirac, Inc; \_\_\_\_\_: [www.unirac.com/#sle](http://www.unirac.com/#sle).
  - 7. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Photovoltaic Combiner Boxes:
  - 1. SMA America, LLC; \_\_\_\_\_: [www.sma-america.com/#sle](http://www.sma-america.com/#sle).
  - 2. SolarBOS, Inc; \_\_\_\_\_: [www.solarbos.com/#sle](http://www.solarbos.com/#sle).

3. Solectria Renewables, LLC; \_\_\_\_\_: [solectria.com/#sle](http://solectria.com/#sle).
  4. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Photovoltaic Inverters:
1. Schneider Electric; \_\_\_\_\_: [www.se.com/#sle](http://www.se.com/#sle).
  2. SMA America, LLC; \_\_\_\_\_: [www.sma-america.com/#sle](http://www.sma-america.com/#sle).
  3. Solectria Renewables, LLC; \_\_\_\_\_: [www.solectria.com/#sle](http://www.solectria.com/#sle).
  4. SolarEdge: [www.solaredge.com](http://www.solaredge.com)
  5. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Monitoring System:
1. Schneider Electric; \_\_\_\_\_: [www.se.com/#sle](http://www.se.com/#sle).
  2. SMA America, LLC; \_\_\_\_\_: [www.sma-america.com/#sle](http://www.sma-america.com/#sle).
  3. Solectria Renewables, LLC; \_\_\_\_\_: [www.solren.com/#sle](http://www.solren.com/#sle).
  4. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Source Limitations: For each type of component, furnish products produced by a single manufacturer and obtained from a single supplier.

## **2.2 PHOTOVOLTAIC SYSTEM REQUIREMENTS**

- A. Provide complete photovoltaic system consisting of photovoltaic modules and associated balance of system components necessary for connection to facility electrical system.
- B. System Description:
1. Photovoltaic array is roof-mounted in location indicated on the drawings.
  2. Orientation of array is as indicated on the drawings.
  3. Photovoltaic DC system is negative grounded.
  4. System includes interconnection with utility grid (grid-tied system).
    - a. Utility metering configuration: Net metering.
  5. System does not include battery storage system.
  6. System does not include engine generator.
  7. System includes DC system surge protection.
  8. System includes monitoring system.
  9. Owner intends to secure funds from available federal, state, and utility company rebate and incentive programs.
- C. Capacity:
1. Total Nominal Rated Power Output of Array: Equal to or greater than the rated output of the basis of design array.
  2. Nominal Rated Power Output of Individual Modules: Equal to or greater than the rated output of the basis of design module.
- D. Size:
1. Array: Designed to fit within the area designated on the drawings.
  2. Individual Modules: Size is not critical.
- E. Appearance:

1. Only systems with similar appearance to basis of design system will be considered.
  2. Arrange array such that modules are aligned with uniform spacing.
  3. Make no alterations affecting appearance of building exterior or interior without approval of LP Consulting Engineers, Inc..
  4. Final determination of acceptable appearance is by LP Consulting Engineers, Inc..
- F. Fire Resistance Rating: Provide photovoltaic module and mounting system combination that together with the roof covering form a system listed in accordance with UL 1703 to provide a fire rating equal to or better than the required fire rating of the roof.
- G. Provide photovoltaic system and associated components suitable for wind loads, snow loads, seismic loads, and other structural design considerations of the installed location.
1. Comply with ASCE 7.
  2. Include structural calculations demonstrating compliance with submittals.
- H. Provide photovoltaic system and associated components suitable for continuous operation under the service conditions at the installed location.
- I. Provide products listed, classified, and labeled as suitable for the purpose intended.
- J. Provide photovoltaic system and associated components that qualify for available federal, state, and utility company rebate and incentive programs.
- K. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system.
- L. DC Arc Fault Circuit Protection: Provide DC photovoltaic arc-fault protection devices listed as complying with UL 1699B as required for compliance with NFPA 70.
- M. Rapid Shutdown of Photovoltaic Systems on Buildings: Provide listed equipment arranged to provide rapid shutdown in accordance with NFPA 70.
- N. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- O. Arrange array to provide adequate access to rear of string(s) for maintenance.
- P. Arrange array to minimize shading during peak production periods.
- Q. Roof-Mounted Arrays:
1. Arrange array such that normal roof drainage is not affected.
  2. Arrange array to maintain required safety clearances from edges of roof as indicated.
  3. Arrange array to maintain access and clearance requirements for other roof-mounted equipment.
  4. Arrange array to avoid spanning of expansion joints.

## **2.3 PHOTOVOLTAIC MODULES**

- A. Acceptable Module Types: Either crystalline silicon or thin film modules complying with specified requirements will be considered for this project.
- B. General Requirements:
  - 1. Photovoltaic Modules: Factory assembled; consisting of photovoltaic cells, frame, junction box, cables for series connection, and bypass diodes for shade tolerance; rated for 600 V DC; complying with IEC 61215-1 and IEC 61215-2 and listed as complying with UL 1703.
  - 2. Crystalline Silicon Photovoltaic Modules: Comply with IEC 61215-1-1.
  - 3. Thin Film Photovoltaic Modules: Comply with IEC 61215-1-2, IEC 61215-1-3, or IEC 61215-1-4 as applicable.
  - 4. Frame: Anodized aluminum.
  - 5. Factory-Installed Junction Box: Weatherproof, with factory-installed terminals and bypass diodes.
  - 6. Factory-Installed Cables: Type USE-2 or listed photovoltaic (PV) wire with polarized locking connectors.
  - 7. Unless otherwise indicated, specified module performance characteristics are rated under Standard Test Conditions (STC).
  - 8. Power Rating Tolerance: Plus 10 or minus 5 percent.
    - a. Include flash test data for each module with source quality control reports to demonstrate compliance.

## **2.4 BALANCE OF SYSTEM COMPONENTS**

- A. Photovoltaic Module Mounting System:
  - 1. Provide complete mounting system compatible with modules to be installed and suitable to properly install them in the location indicated, including all necessary hardware and accessories.
  - 2. Support Structure and Associated Hardware Materials: Use aluminum, galvanized steel, or stainless steel.
  - 3. Roof-Mounted Arrays:
    - a. Acceptable System Types: Either non-penetrating or penetrating systems complying with specified requirements will be considered for this project.
    - b. Provide system compatible with the roof at the installed location.
    - c. Module Tilt Angle: As required to provide maximum energy production for installed location.
    - d. Provide minimum clearance of 3 inches between roof and module for air circulation and drainage.
- B. Photovoltaic Combiner Boxes:
  - 1. Provide combiner box(es) for termination of strings as indicated or as required for the array configuration installed.
  - 2. Combiner Boxes: Rated for 600 V DC; current ratings suitable for connected strings; equipped with fuseholders; listed as complying with UL 1741.

3. Fuseholders: Touch-safe; suitable to accept fuses indicated.
  4. Number of Input Circuits: As indicated or as required for termination of strings, with minimum of 25 percent spare capacity for future expansion.
  5. Enclosure: NEMA EN 10250, Type 3R, unless otherwise indicated.
  6. Provide integral load-break rated disconnect.
  7. Provide with capability of current monitoring for individual strings.
- C. Photovoltaic Inverters:
1. Provide inverter(s) as indicated or as required for connection of the photovoltaic array DC system to the AC system indicated.
  2. Inverters: Suitable for the requirements of the connected array; output configuration compatible with connected system; listed as complying with UL 1741; furnished with the following features:
    - a. Maximum power point tracking (MPPT).
    - b. LCD display.
    - c. Integral AC disconnect.
    - d. Integral DC disconnect.
    - e. Integral DC ground fault detection and interruption (GFDI).
    - f. Communications Interface: As required for connection to system indicated.
  3. Grid-Tied Inverters: Comply with IEEE 1547, including over/under grid voltage and frequency protection, and anti-islanding protection to automatically disconnect upon loss of utility power and to remain disconnected until utility power restoration has been maintained for five minutes.
  4. Grounded Photovoltaic DC Systems: Furnish with integral isolation transformer. Transformerless inverters may be used if a separate isolation transformer is provided.
  5. Total Harmonic Distortion: Less than five percent.
  6. Enclosure Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
- D. Isolation Transformers: Comply with Section 26 22 00 .
- E. Enclosed Switches, in Addition to Requirements of Section 26 28 16.16:
1. Switches for DC System: Rated for 600 V DC.
  2. Switches Connected to Supply Side of Service Disconnecting Means: Listed and labeled as suitable for use as service equipment according to UL 869A.
- F. Surge Protective Devices, in Addition to Requirements of Section 26 43 00:
1. Surge Protective Devices for DC System:
    - a. Rated for 600 V DC.
    - b. Listed and labeled as complying with UL 1449, Type 1.
    - c. Surge Current Rating: Not less than 50 kA per mode.

- d. UL 1449 Nominal Discharge Current (I-n): 20 kA.
- G. Molded-Case Circuit Breakers and Switches for DC System: Rated for 600 V DC; listed as complying with UL 489B.
- H. Fuses, in Addition to Requirements of Section 26 28 13:
  - 1. Fuses for DC System: Rated for 600 V DC.
  - 2. Fuses for Protection of Photovoltaic Strings and Arrays: Photovoltaic fuses listed as complying with UL 2579.
- I. Monitoring System:
  - 1. Provide a system to monitor photovoltaic system performance including all sensors, dataloggers, connections, software, equipment and accessories necessary for a complete operating system.
  - 2. System communications interfaces to be wired or wireless, with compatible interconnected components.
    - a. Provide suitable raceway, minimum 3/4 inch trade size, for all required wired connections.
  - 3. System to monitor and record, in 15 minute intervals:
    - a. Inverter status.
    - b. Instantaneous power (kW).
    - c. Cumulative energy production (kWh).
    - d. Irradiation.
    - e. Ambient temperature.
    - f. Module cell temperature.
    - g. Wind speed and direction.
    - h. Current monitoring for individual strings.
  - 4. Energy Production Meter: Revenue grade, with accuracy of plus or minus two percent.
  - 5. System real-time and historical data to be accessible from the following locations:
    - a. Personal computer(s), via internet connection.
    - b. Remote personal display(s), quantity and location as indicated on the drawings.
    - c. Remote public display(s), quantity and location as indicated on the drawings.
  - 6. System to provide alarm notification via e-mail or instant message.
  - 7. System to be compatible with third party monitoring service to be selected by Owner.

## **2.5 SOURCE QUALITY CONTROL**

- A. Factory test the following products to verify operation and performance characteristics. Include test reports with submittals.
  - 1. Photovoltaic modules.
  - 2. Photovoltaic inverters.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that ratings and configurations of system components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive system components.
- D. Verify that conditions are satisfactory for installation prior to starting work.

### **3.2 PREPARATION**

- A. Use open circuiting, short circuiting, or opaque covering to disable modules, array or portions of array prior to installation and service.
- B. Roof-Mounted Arrays: Protect roof and adjacent roof-mounted items from damage.

### **3.3 INSTALLATION**

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install photovoltaic system in accordance with NECA 412.
- D. Provide required support and attachment in accordance with Section 26 05 29.
- E. Provide required seismic controls in accordance with Section 26 05 48.
- F. Mount equipment such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor, ground, or working platform.
- G. Circuiting Requirements. in Addition to Requirements of Section 26 05 19:
  - 1. Wiring Methods:
    - a. Unless otherwise indicated, use exposed module factory-installed cables (not routed inside building) for module interconnections.
    - b. Unless otherwise indicated, use exposed type USE-2/RHH/RHW-2 single-conductor cable or listed photovoltaic wire (not routed inside building) for wiring between string(s) and combiner box(es).
    - c. Unless otherwise indicated, use type THHN/THWN-2 single-conductor building wire in suitable raceway for wiring between combiner box(es) and point of interconnection.
    - d. Secure exposed cables in accordance with NFPA 70. Where possible, conceal behind array.
    - e. Install cables in suitable raceway where readily accessible or where required by authority having jurisdiction.
    - f. Use suitable twist-on insulated spring connectors, mechanical connectors, or compression connectors for photovoltaic circuit splices and taps.
  - 2. Photovoltaic DC System Conductor Color Code:
    - a. Negative Grounded System:
      - 1) Positive: Red.



- 2) Negative/Grounded: White.
  3. Maintain separation of photovoltaic and non-photovoltaic circuits in accordance with NFPA 70.
- H. Grounding and Bonding Requirements, in Addition to Requirements of Section 26 05 26:
1. Ensure that there is only one AC System bonding connection between grounding system and grounded/neutral conductor, including external connections and connections internal to equipment.
  2. Grounded DC Systems: Ensure that there is only one point of system grounding connection to the grounded conductor, including external connections and connections internal to equipment.
  3. Provide auxiliary electrodes for photovoltaic array grounding in accordance with NFPA 70.
- I. Identification Requirements, in Addition to Those Specified in Section 26 05 53:
1. Color for Photovoltaic System Identification Nameplates and Labels: White text on red background, unless otherwise required by NFPA 70 or authorities having jurisdiction.
  2. Use identification nameplate or means of identification acceptable to authority having jurisdiction to identify the presence of multiple power sources and the location of main service disconnecting means and each photovoltaic system disconnecting means. Locate at main service disconnecting means and at each photovoltaic system disconnecting means. Verify format and descriptions with authorities having jurisdiction.
  3. Use identification nameplate to identify each photovoltaic system disconnecting means with text "PV SYSTEM DISCONNECT".
  4. Use identification nameplate or identification label to identify systems equipped with rapid shutdown and associated rapid shutdown switch(es). Format, descriptions, and locations to comply with NFPA 70 and requirements of authorities having jurisdiction.
  5. Use identification nameplate or identification label to identify the information required by NFPA 70 for marking of direct-current photovoltaic power sources. Locate at each DC disconnect means requiring marking.
  6. Use identification nameplate or identification label to identify the interactive system point of interconnection at the disconnecting means as a power source and with the rated AC output current and the nominal operating AC voltage.
  7. Where the inverter output connection is located in a panelboard on the opposite (load) end from the input feeder location or main circuit location in order to meet requirements of NFPA 70, use identification nameplate or identification label to identify the overcurrent device with the word message "Warning; Inverter output connection; Do not relocate this overcurrent device".

8. Use warning labels to identify electrical hazards for photovoltaic system disconnecting means. Include the word message "Warning - Electric Shock Hazard; Terminals on the line and load sides may be energized in the open position" or approved equivalent.
9. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for photovoltaic systems equipped with DC ground-fault protection in accordance with NFPA 70. Include the word message "Warning - Electric Shock Hazard; If a ground fault is indicated, normally grounded conductors may be ungrounded and energized".
10. Use wire and cable markers to identify photovoltaic system source, output, and inverter circuit conductors at all points of termination, connection, and splices.
11. Use voltage markers, identification labels, stenciled text, or suitable permanent marking approved by authority having jurisdiction to identify exposed raceways, cable trays, pull boxes, junction boxes, and conduit bodies with the text "Warning: Photovoltaic Power Source" at maximum intervals of 10 feet in accordance with NFPA 70.

### **3.4 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. See article "SYSTEM STARTUP" below for additional requirements related to testing and inspection.
- C. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.
- D. Inspection and testing to include, at a minimum:
  1. Inspect each system component for damage and defects.
  2. Verify that equipment enclosures, boxes, and associated connections installed outdoors are weatherproof.
  3. Verify proper wiring connections have been made and check for conductor continuity. Verify proper polarity.
  4. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
  5. Perform insulation resistance tests.
    - a. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
  6. Measure and record ambient conditions, including date and time, ambient temperature, cell temperature, solar irradiance in the module plane, and wind speed.
  7. Measure and record open circuit voltage of each string.
  8. Measure and record voltages at the inverter AC and DC inputs.
  9. Measure and record operating current for each string, sub-array, and array.

10. Measure and record AC output power.
  11. Perform inverter functional test.
    - a. Grid-Tied Inverters: Include simulation of loss of utility power and subsequent power restoration.
  12. Verify proper operation of monitoring system.
- E. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
  - F. Diagnostic Period: After successful completion of inspections and tests, operate system in normal mode for at least 14 days without any system or equipment malfunctions.
    1. Record all system operations and malfunctions.
    2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
  - G. Submit detailed reports indicating inspection and testing results and corrective actions taken.
  - H. Repair roof or adjacent roof-mounted items damaged as a result of work of this section.

### **3.5 SYSTEM STARTUP**

- A. Provide services of a manufacturer's authorized representative to assist in performing system startup. Include manufacturer's detailed startup procedures with submittals.
- B. Obtain Owner's approval prior to performing system startup.
- C. Grid-Tied Systems: Obtain Utility Company's approval prior to performing system startup.
- D. Prepare and start system in accordance with manufacturer's instructions.

### **3.6 CLEANING**

- A. Clean modules using only methods recommended by manufacturer to avoid scratches and other damage. Clean exposed surfaces on other components to remove dirt, paint, or other foreign material and restore to match original factory finish.

### **3.7 COMMISSIONING**

- A. See Section 01 91 13 - General Commissioning Requirements for commissioning requirements.

### **3.8 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

- D. Training: Train Owner's personnel on operation, adjustment, and maintenance of photovoltaic system.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of four hours of training.
  - 3. Instructor: Manufacturer's authorized representative.
  - 4. Location: At project site.

### **3.9 PROTECTION**

- A. Protect installed products from subsequent construction operations.

### **3.10 MAINTENANCE**

- A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide to Owner, a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of photovoltaic system for two years from date of Substantial Completion, to include the work described below; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
- C. Conduct site visit at least once every six months to perform inspection, testing, and preventive maintenance. Conduct tests similar to those made during original field quality control testing. Submit report to Owner comparing test results with those of original tests along with evaluations and recommendations.
- D. Provide trouble call-back service upon notification by Owner:
  - 1. Include allowance for call-back service during normal working hours at no extra cost to Owner.
  - 2. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

**SECTION 26 33 23**  
**CENTRAL BATTERY EQUIPMENT**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Fast-transfer interruptible power supply (IPS) centralized emergency lighting inverters.

**1.2 RELATED REQUIREMENTS**

- A. Section : Concrete equipment pads.
- B. Section .
- C. Section .
- D. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
  - 1. Includes requirements for the seismic qualification of equipment specified in this section.
- E. Section : Identification products and requirements.
- F. Section : Additional criteria for the selection of equipment and associated protective devices specified in this section.
- G. Section :
  - 1. Luminaires for interface with centralized emergency lighting inverters.
- H. Section : Luminaires for interface with centralized emergency lighting inverters.

**1.3 REFERENCE STANDARDS**

- A. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).
- B. ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- D. NECA 416 - Recommended Practice for Installing Energy Storage Systems (ESS); 2016.
- E. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- F. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. NFPA 111 - Standard on Stored Electrical Energy Emergency and Standby Power Systems; 2025.

- J. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate compatibility of centralized emergency lighting inverters to be installed with work provided under other sections or by others.
    - a. Luminaires: See Section .
  - 2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
  - 3. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 4. Coordinate the work with placement of supports, anchors, etc. required for mounting.
  - 5. Notify LP Consulting Engineers, Inc. of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Preinstallation Meeting: Convene before starting work of this section; require attendance of all affected installers.
- C. Where work of this section involves interruption of power to existing emergency lighting, arrange power interruption with Owner.

#### **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.
  - 1. Where applicable, include characteristic trip curves for overcurrent protective devices.
  - 2. Indicate any inverter load restrictions.
  - 3. Identify mounting conditions required for equipment seismic qualification.
- C. Shop Drawings: Indicate dimensions, input/output voltages, power ratings, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, and installed features and accessories.
  - 1. Include dimensioned plan and elevation views of inverters and adjacent equipment with all required clearances indicated.
  - 2. Include wiring diagrams showing all factory and field connections.
  - 3. Include documentation demonstrating selective coordination.
- D. Derating Calculations: Indicate ratings adjusted for applicable service conditions and/or inverter load restrictions.
- E. Specimen Warranty: Submit sample of manufacturer's warranty.
- F. Evidence of qualifications for manufacturer.
- G. Evidence of qualifications for installer.

- H. Evidence of qualifications for maintenance contractor (if different entity from installer).
- I. Manufacturer's equipment seismic qualification certification.
- J. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.
- K. Manufacturer's certification that products meet or exceed specified requirements.
- L. Source quality control test reports.
- M. Provide NFPA 111 required documentation from manufacturer.
- N. Manufacturer's detailed field testing procedures.
- O. Field quality control test reports.
- P. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
  - 1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- Q. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- R. Maintenance contracts.
- S. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.
- T. Maintenance Materials: Furnish the following for Owner's (Owner's) use in maintenance of project.
  - 1. See Section , for additional provisions.
  - 2. Enclosure Keys: of each different key.
  - 3. Battery Fuses: See Section for requirements for spare fuses and spare fuse cabinets.

## **1.6 QUALITY ASSURANCE**

- A. Comply with the following:
  - 1. NFPA 70 (National Electrical Code).
  - 2. NFPA 101 (Life Safety Code).
  - 3. NFPA 111.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum years experience.
  - 1. Authorized service facilities located within of project site.

- D. Installer Qualifications: Company with minimum years experience with centralized emergency lighting inverter systems of similar size, type, and complexity.
- E. Maintenance Contractor Qualifications:
  - 1. Contract maintenance office located within of project site.
- F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's instructions to avoid damage to inverter system components, enclosure, and finish.
- D. Do not exceed maximum ambient temperature requirements for batteries at any time, which reduces battery service life. Replace batteries exposed to temperatures in excess of manufacturer's requirements.

#### **1.8 FIELD CONDITIONS**

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

#### **1.9 WARRANTY**

- A. See Section , for additional warranty requirements.
- B. Inverter Assemblies: Provide minimum two year manufacturer warranty covering repair or replacement due to defective materials or workmanship.
- C. Batteries: Provide pro-rata warranty for the duration of rated design life.

### **PART 2 PRODUCTS**

#### **2.1 CENTRALIZED EMERGENCY LIGHTING INVERTERS - GENERAL REQUIREMENTS**

- A. Provide complete centralized emergency lighting inverter system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Inverter Assemblies: Manufactured units consisting of inverters, batteries, enclosures, and associated components specifically designed for emergency lighting applications; microprocessor-based utilizing pulse width modulation



- (PWM) with insulated gate bipolar transistors (IGBT's); listed and labeled as complying with UL 924.
1. Battery Run Times of 90 Minutes: Listed as complying with UL 924 for "emergency lighting and power equipment".
  2. Battery Run Times Other than 90 Minutes: Listed as complying with UL 924 for "auxiliary lighting and power equipment".
- D. Provide inverters and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
1. Ambient Temperature (Inverter): Between 32 degrees F and 104 degrees F.
  2. Ambient Temperature (Battery): Between 68 degrees F and 86 degrees F.
- E. Increase indicated power ratings as required to accommodate any applicable inverter load restrictions.
- F. Battery System:
1. Provide battery capacity as required for achieving battery run time indicated.
  2. Battery Charger: Microprocessor-controlled, temperature compensated; capable of returning supplied battery(s) from fully discharged to fully charged condition within unless otherwise indicated.
  3. Provide automatic low voltage battery disconnect to prevent battery "deep discharge" damage.
- G. Seismic Qualification: Provide emergency lighting inverters and associated components suitable for application under the seismic design criteria specified in Section 26 05 48 where required. Include certification of compliance with submittals.
- H. Enclosures:
1. Environment Type per NEMA EN 10250:
    - a. Indoor Clean, Dry Locations:
    - b. Outdoor Locations:
  2. Hinged Doors: Lockable, with all locks keyed alike.
  3. Finish:
- I. Short Circuit Current Rating: Provide inverter assemblies with listed short circuit current rating of 65k AIC or not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
- J. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category B.
- K. Automatic Sequence of Operations:
1. Upon failure or degradation of primary/normal input power, transfer load to battery power.

2. When primary/normal input power has been restored, retransfer load to primary/normal power and recharge battery.
- L. Input Tolerance:
1. Voltage Range:
  2. Frequency Range: 1 percent of nominal.
  3. Total Harmonic Distortion (THD): maximum at full load.
- M. Output Requirements:
1. Voltage Regulation:
  2. Frequency Range:
  3. Total Harmonic Distortion (THD): maximum for linear load.
  4. Load Power Factor Capability: From 0.5 lagging to 0.5 leading.
- N. Features:
1. Control Functions:
    - a. Automatic mode.
    - b. Manual Test Mode: Simulates failure of primary/normal source.
    - c. Self-testing/self-diagnostics.
  2. Status Indications:
    - a. Connected to primary/normal source.
    - b. Connected to battery power.
    - c. Primary/normal source available.
    - d. Battery charging.
  3. Alarm Indications (Units with Self-Testing/Self-Diagnostics):
    - a. General trouble/alarm.
- O. Features:
1. Control Functions:
    - a. Automatic mode.
    - b. Manual Test Mode: Simulates failure of primary/normal source.
    - c. Automatic Shutdown Mode (IPS Inverters Only): Upon applicable inverter circuit trouble/fault unit shuts down.
    - d. Manual Bypass Mode: Manual bypass switch removes unit from circuit and delivers power directly from primary/normal source to load for unit maintenance purposes.
    - e. Self-testing/self-diagnostics.
  2. Status Indications:
    - a. Connected to primary/normal source.
    - b. Connected to battery power.
    - c. Primary/normal source available.
    - d. Battery charging.
    - e. Unit in manual bypass mode.
  3. Measured Parameter Indications:
    - a. Battery voltage.
    - b. Output voltage (Volts AC); line-to-line and line-to-neutral; .

- c. Output Current (Amps); .
  - d. Output apparent power (kVA); .
  - e. Temperature.
- 4. Alarm Indications:
  - a. Output overload/overcurrent.
  - b. High temperature.
  - c. Low battery.
  - d. Output circuit breaker open (supervised circuit breakers only).
- 5. Other Features:
  - a. Input circuit breaker.
  - b. Event log.
  - c. Communications Capability: Compatible with system indicated.  
Provide all accessories necessary for proper interface.
  - d. Remote monitoring capability.

## **2.2 FAST-TRANSFER INTERRUPTIBLE POWER SUPPLY (IPS) CENTRALIZED EMERGENCY LIGHTING INVERTERS**

- A. Manufacturers:
  - 1. Myers Emergency Power Systems; <https://www.myerseps.com/>
  - 2. Acuity Brands, Inc: [www.acuitybrands.com/#sle](http://www.acuitybrands.com/#sle).
  - 3. Eaton Corporation: [www.eaton.com/#sle](http://www.eaton.com/#sle).
  - 4. Substitutions:
  - 5. Source Limitations: Furnish inverter assemblies and accessories produced by a single manufacturer and obtained from a single supplier.
- B. Description: Offline/standby or online, line interactive type inverters with maximum transfer time to battery power source upon loss of normal power source; suitable for emergency operation of incandescent, LED, fluorescent, and HID light sources.
- C. Fast-Transfer Interruptible Power Supply (IPS) Centralized Emergency Lighting Inverter:
  - 1. Nominal Input/Output Voltage: As indicated on drawings.
  - 2. Nominal Power Rating: As indicated on drawings.
  - 3. Battery Type: Valve-regulated lead acid (VRLA)/sealed lead calcium with 10 year design life.
  - 4. Battery Run Time at Full Output:
  - 5. Output Circuit Breaker(s): As indicated on drawings.
  - 6. Features:
    - a. manual bypass switch.
    - b. Normally off output bus.
    - c. Outputs:
      - 1) Contact for power on status.
      - 2) Contacts for power source status (primary/normal or battery).
      - 3) Contacts for alarm conditions.

- 4) Contact for maintenance bypass switch status.

## **2.3 SOURCE QUALITY CONTROL**

- A. See Section , for additional requirements.
- B. Perform production tests on inverter assemblies at factory to verify operation and performance characteristics prior to shipment.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of inverter assemblies are consistent with the indicated requirements.
- C. Verify that rough-ins for field connections are in the proper locations.
- D. Verify that mounting surfaces are ready to receive inverter assemblies.
- E. Verify that conditions are satisfactory for installation prior to starting work.

### **3.2 INSTALLATION**

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install inverter assemblies in accordance with applicable requirements of NECA 416.
- C. Install products in accordance with manufacturer's instructions.
- D. Arrange equipment to provide minimum clearances and required maintenance access.
- E. Provide required support and attachment in accordance with Section .
- F. Provide required seismic controls in accordance with Section 26 05 48.
- G. Install inverter assemblies plumb and level.
- H. Unless otherwise indicated, mount floor-mounted inverter assemblies on properly sized high concrete pad constructed in accordance with Section .
- I. Provide grounding and bonding in accordance with Section .
- J. Identify inverter assemblies and associated system wiring in accordance with Section .

### **3.3 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Provide services of a manufacturer's authorized representative to . Include manufacturer's with submittals.
- C. Notify Owner (Owner) and LP Consulting Engineers, Inc. at least two weeks prior to scheduled inspections and tests.
- D. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

- E. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank.
- F. Prepare and start system in accordance with manufacturer's instructions.
- G. Perform acceptance test in accordance with NFPA 111.
- H. Inspect and test in accordance with NETA ATS, except Section 4.
- I. Perform inspections and tests listed in NETA ATS, Section 7.22.2.
- J. Batteries and Charger: Perform inspections and tests listed in NETA ATS, Section 7.18.
- K. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- L. Submit detailed reports indicating inspection and testing results and corrective actions taken.

### **3.4 CLEANING**

- A. See Section , for additional requirements.
- B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

### **3.5 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of emergency lighting inverter system to Owner (Owner), and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's (Owner's) personnel on operation, adjustment, and maintenance of emergency lighting inverter system.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of of training.
  - 3. Instructor:
  - 4. Location:

### **3.6 PROTECTION**

- A. Protect installed inverter assemblies from subsequent construction operations.

### **3.7 MAINTENANCE**

- A. See Section , for additional requirements relating to maintenance service.
- B. Provide to Owner (Owner) a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of emergency lighting inverter system for two years from date of Substantial Completion;

Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

- C. Conduct site visit at least once every six months to perform inspection, testing, and preventive maintenance. Submit report to Owner (Owner) indicating maintenance performed along with evaluations and recommendations.
- D. Provide trouble call-back service upon notification by Owner (Owner):
  - 1. Provide on-site response within of notification.
  - 2. Include allowance for call-back service during normal working hours at no extra cost to Owner (Owner).
  - 3. Owner (Owner) will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- E. Maintain an on-site log listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced.

**SECTION 26 43 00  
SURGE PROTECTIVE DEVICES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Surge protective devices for service entrance locations.

**1.2 RELATED REQUIREMENTS**

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 24 13 - Switchboards.
- C. Section 26 24 16 - Panelboards.

**1.3 ABBREVIATIONS AND ACRONYMS**

- A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.
- B. SPD: Surge Protective Device.

**1.4 REFERENCE STANDARDS**

- A. MIL-STD-220 - Method of Insertion Loss Measurement; 2009c (Validated 2024).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.
- D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 1283 - Standard for Electromagnetic Interference Filters; Current Edition, Including All Revisions.
- G. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

**1.5 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify LP Consulting Engineers, Inc. of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

**1.6 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means

including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

1. SPDs with EMI/RFI filter: Include noise attenuation performance.
- C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.
- D. Certificates: Manufacturer's documentation of listing for compliance with the following standards:
  1. UL 1449.
  2. UL 1283 (for Type 2 SPDs).
- E. Field Quality Control Test Reports.
- F. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.
- H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- I. Project Record Documents: Record actual connections and locations of surge protective devices.

#### **1.7 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### **1.8 DELIVERY, STORAGE, AND PROTECTION**

- A. Store in a clean, dry space in accordance with manufacturer's written instructions.

#### **1.9 FIELD CONDITIONS**

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

#### **1.10 WARRANTY**



- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.
- C. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Field-Installed, Externally Mounted Surge Protective Devices:
  - 1. ABB: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).
  - 2. Intermatic, Inc: [www.intermatic.com/#sle](http://www.intermatic.com/#sle).
  - 3. nVent ERICO: [www.nvent.com/#sle](http://www.nvent.com/#sle).
  - 4. Schneider Electric: [www.se.com/#sle](http://www.se.com/#sle).
  - 5. Surge Suppression, LLC (SSI): [www.surgesuppression.com/#sle](http://www.surgesuppression.com/#sle).
  - 6. \_\_\_\_\_.
- B. Factory-installed, Internally Mounted Surge Protective Devices:
  - 1. Same as manufacturer of equipment containing surge protective device, to provide complete listed assembly including SPD.
- C. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Source Limitations: Provide surge protective devices produced by single manufacturer and obtained from single supplier.

### **2.2 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS**

- A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.
- B. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.
- C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.
- D. Protected Modes:
  - 1. Wye Systems: L-N, L-G, N-G, L-L.
  - 2. Delta Systems: L-G, L-L.
  - 3. Single Split Phase Systems: L-N, L-G, N-G, L-L.
  - 4. High Leg Delta Systems: L-N, L-G, N-G, L-L.
- E. UL 1449 Voltage Protection Ratings (VPRs):
  - 1. 480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,000 V for L-L mode.

- F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.
- G. Enclosure Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
  - 1. Indoor clean, dry locations: Type 1.
  - 2. Outdoor locations: Type 3R.
- H. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:
  - 1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.
  - 2. Provide flush-mounted SPD where mounted in public areas or adjacent to flush-mounted equipment.
- I. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
  - 1. Switchboards: See Section 26 24 13.
  - 2. Panelboards: See Section 26 24 16.

## **2.3 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS**

- A. Surge Protective Device:
  - 1. Protection Circuits: Field-replaceable modular or non-modular.
  - 2. Surge Current Rating: Not less than 120 kA per mode/240 kA per phase.
  - 3. Repetitive Surge Current Capacity: Not less than 5,000 impulses.
  - 4. UL 1449 Nominal Discharge Current (I-n): 20 kA.
  - 5. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
  - 6. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).
    - a. Noise Attenuation: Not less than 40 dB at 100 kHz using MIL-STD-220 insertion loss test method.
  - 7. Diagnostics:
    - a. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.
    - b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
    - c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.
    - d. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.
  - 8. Provide surge rated integral disconnect switch for SPDs \_\_\_\_\_.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.
- C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.
- D. Verify system grounding and bonding is in accordance with Section 26 05 26, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.
- E. Verify that conditions are satisfactory for installation prior to starting work.

### **3.2 INSTALLATION**

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.
- E. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.
- F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.
- G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 05 26 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.
- H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

### **3.3 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS Section 7.19.1.

- D. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

### **3.4 CLEANING**

- A. Repair scratched or marred exterior surfaces to match original factory finish.

**SECTION 26 51 00  
INTERIOR LIGHTING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Interior luminaires.
- B. Exit signs.
- C. Ballasts and drivers.

**1.2 RELATED REQUIREMENTS**

- A. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- B. Section 26 05 33.16 - Boxes for Electrical Systems.
- C. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 09 23 - Lighting Control Devices.
  - 1. Includes automatic controls for lighting including occupancy sensors, outdoor motion sensors, time switches, outdoor photo controls, and daylighting controls.
  - 2. Includes lighting contactors.
- F. Section 26 27 26 - Wiring Devices: Manual wall switches and wall dimmers.
- G. Section 26 56 00 - Exterior Lighting.

**1.3 REFERENCE STANDARDS**

- A. 47 CFR 15 - Radio Frequency Devices; current edition.
- B. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).
- C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).
- D. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.
- E. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2024.
- F. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- H. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems; 2006.
- I. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.
- J. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2023.

- K. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.
- L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. UL 844 - Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.
- O. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- P. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- Q. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
  - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
  - 3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
  - 4. Notify LP Consulting Engineers, Inc. of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

#### **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
  - 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
  - 2. Provide photometric calculations where luminaires are proposed for substitution.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
  - 1. LED Luminaires:

- a. Include estimated useful life, calculated based on IES LM-80 test data.
  - b. Include IES LM-79 test report upon request.
- 2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
- D. Samples:
  - 1. Provide one sample(s) of each specified luminaire where indicated.
  - 2. Provide one sample(s) of each custom luminaire.
  - 3. Provide one sample(s) of each luminaire proposed for substitution upon request.
  - 4. Provide one sample(s) of each product finish illustrating color and texture upon request.
- E. Field quality control reports.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
- I. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

## **1.6 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## **1.7 DELIVERY, STORAGE, AND PROTECTION**

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

## **1.8 FIELD CONDITIONS**

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

## **1.9 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide 3-year manufacturer warranty for LED luminaires, including drivers.
- C. Provide 10-year pro-rata warranty for batteries for self-powered exit signs.

## **PART 2 PRODUCTS**

### **2.1 LUMINAIRE TYPES**

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.2 LUMINAIRES**

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Provide products complying with Federal Energy Management Program (FEMP) requirements.
- E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- H. Recessed Luminaires:
  - 1. Ceiling Compatibility: Comply with NEMA LE 4.
  - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
  - 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- I. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.



- J. LED Luminaires:
  - 1. Components: UL 8750 recognized or listed as applicable.
  - 2. Tested in accordance with IES LM-79 and IES LM-80.
  - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
- K. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
  - 1. LED Tape - General Requirements:
    - a. Listed.
    - b. Designed for field cutting in accordance with listing.
    - c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.
  - 2. White LED Tape:
    - a. Correlated Color Temperature (CCT): 3500 K unless otherwise indicated.
    - b. Color Rendering Index (CRI): Not less than 90.
- L. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.
- M. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

## **2.3 EXIT SIGNS**

- A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
  - 1. Number of Faces: Single- or double-face as indicated or as required for installed location.
  - 2. Directional Arrows: As indicated or as required for installed location.
- B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.
- C. Accessories:
  - 1. Provide compatible accessory high-impact polycarbonate vandal shields where indicated.
  - 2. Provide compatible accessory wire guards where indicated.

## **2.4 BALLASTS AND DRIVERS**

- A. Ballasts/Drivers - General Requirements:
  - 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
  - 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
  - 3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

- B. Dimmable LED Drivers - Network-Connected: Comply with Section \_\_\_\_\_.

## **2.5 ACCESSORIES**

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.
- C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

### **3.2 PREPARATION**

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

### **3.3 INSTALLATION**

- A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install products in accordance with manufacturer's instructions.
- D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Provide required seismic controls in accordance with Section 26 05 48.
- G. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- H. Suspended Ceiling Mounted Luminaires:
  - 1. Do not use ceiling tiles to bear weight of luminaires.
  - 2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
  - 3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.

4. Secure pendant-mounted luminaires to building structure.
  5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
  6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.
  7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- I. Recessed Luminaires:
1. Install trims tight to mounting surface with no visible light leakage.
  2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
  3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- J. Suspended Luminaires:
1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
  2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
  3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
  4. Install canopies tight to mounting surface.
  5. Unless otherwise indicated, support pendants from swivel hangers.
- K. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- L. Install accessories furnished with each luminaire.
- M. Bond products and metal accessories to branch circuit equipment grounding conductor.
- N. Exit Signs:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
  2. Install lock-on device on branch circuit breaker serving units.
- O. Remote Drivers: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.
- P. Identify luminaires connected to emergency power system in accordance with Section 26 05 53.

### **3.4 FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Test self-powered exit signs to verify proper operation upon loss of normal power supply.
- E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by LP Consulting Engineers, Inc..

### **3.5 ADJUSTING**

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by LP Consulting Engineers, Inc.. Secure locking fittings in place.
- B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by LP Consulting Engineers, Inc. or authority having jurisdiction.
- C. Air-Handling Luminaires with Air Control Blades or Heat Removal Dampers: Adjust as indicated or as required for proper airflow as directed by LP Consulting Engineers, Inc..
- D. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by LP Consulting Engineers, Inc. or authority having jurisdiction.
- E. Aim and adjust fixtures as indicated and/or as directed by the Architect or Electrical Engineer of Record.

### **3.6 CLEANING**

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosures.
- D. Clean finishes and touch up damage.

### **3.7 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of luminaires to LP Consulting Engineers, Inc. or designated representative, and correct deficiencies or make adjustments as directed.

- D. Just prior to Substantial Completion, replace all lamps that have failed.

### **3.8 PROTECTION**

- A. Protect installed luminaires from subsequent construction operations.

**SECTION 26 56 00  
EXTERIOR LIGHTING**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Exterior luminaires.
- B. Ballasts and drivers.
- C. Poles and accessories.
- D. Luminaire accessories.

**1.2 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 33.16 - Boxes for Electrical Systems.
- E. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- F. Section 26 09 23 - Lighting Control Devices.
  - 1. Includes automatic controls for lighting including outdoor motion sensors, time switches, and outdoor photo controls.
  - 2. Includes lighting contactors.
- G. Section 26 27 26 - Wiring Devices: Receptacles for installation in poles.
- H. Section 26 28 13 - Fuses.
- I. Section 26 51 00 - Interior Lighting.

**1.3 REFERENCE STANDARDS**

- A. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals; 2013, with Editorial Revision (2022).
- B. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2023.
- C. ANSI O5.1 - American National Standard for Wood Poles: Specifications and Dimensions; 2022.
- D. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).
- E. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.
- F. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).
- G. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

- H. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2024.
- I. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.
- J. IES RP-8 - Recommended Practice: Lighting Roadway and Parking Facilities; 2025.
- K. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
- L. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).
- M. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2023.
- N. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.
- O. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- P. UL 844 - Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.
- Q. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- R. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
  - 2. Notify Architect and/or District Representative of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

#### **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
  - 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
  - 2. Provide photometric calculations where luminaires are proposed for substitution.
  - 3. Provide structural calculations for each pole proposed for substitution.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric

performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:
    - a. Include estimated useful life, calculated based on IES LM-80 test data.
    - b. Include IES LM-79 test report upon request.
  2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
  3. LED Retrofit Luminaire Conversion Kits: Include list of compatible luminaires and/or criteria for compatibility.
  4. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.
- D. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.
- E. Samples:
1. Provide one sample(s) of each specified luminaire where indicated.
  2. Provide one sample(s) of each luminaire proposed for substitution upon request.
  3. Provide one sample of each product finish illustrating color and texture upon request.
- F. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.
- G. Field Quality Control Reports.
1. Include test report indicating measured illumination levels.
- H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- I. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Extra Fuses: Five percent of total quantity installed for each type, but not less than two of each type.
  3. Touch-Up Paint: 2 gallons, to match color of pole finish.
- K. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

## **1.6 QUALITY ASSURANCE**



- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.
- C. Receive, handle, and store wood poles in accordance with ANSI O5.1.

#### **1.8 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide 2-year manufacturer warranty for all LED luminaires, including drivers.

### **PART 2 PRODUCTS**

#### **2.1 LUMINAIRE TYPES**

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.2 LUMINAIRES**

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Provide products complying with Federal Energy Management Program (FEMP) requirements.
- E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- F. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

- G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- H. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.
- I. Recessed Luminaires:
  - 1. Ceiling Compatibility: Comply with NEMA LE 4.
  - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
  - 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- J. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.
- K. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.
- L. LED Luminaires:
  - 1. Components: UL 8750 recognized or listed as applicable.
  - 2. Tested in accordance with IES LM-79 and IES LM-80.
  - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
- M. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
  - 1. LED Tape - General Requirements:
    - a. Listed.
    - b. Designed for field cutting in accordance with listing.
    - c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.
  - 2. White LED Tape:
    - a. Correlated Color Temperature (CCT): 3500 K unless otherwise indicated.
    - b. Color Rendering Index (CRI): Not less than 90.
- N. Exposed Hardware: Stainless steel.

## **2.3 BALLASTS AND DRIVERS**

- A. Ballasts/Drivers - General Requirements:
  - 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
  - 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
  - 3. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.
- B. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.

## **2.4 POLES**

### **A. All Poles:**

1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
2. Structural Design Criteria:
  - a. Comply with AASHTO LTS.
  - b. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
    - 1) Design Wind Speed: 100 miles per hour, with gust factor of 1.3.
  - c. Dead Load: Include weight of proposed luminaire(s) and associated supports and accessories.
  - d. Include structural calculations demonstrating compliance with submittals.
3. Material: Steel, unless otherwise indicated.
4. Shape: Square straight, unless otherwise indicated.
5. Finish: Match luminaire finish, unless otherwise indicated.
6. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
7. Unless otherwise indicated, provide with the following features/accessories:
  - a. Top cap.
  - b. Handhole, standard size.
  - c. Anchor bolts with leveling nuts or leveling shims.
  - d. Anchor base cover.
  - e. Provision for pole-mounted weatherproof GFI receptacle where indicated.
  - f. Brackets: As required by manufacturer.
  - g. Hinged base.
  - h. Pole-top tenon, as indicated on the drawings.

- B. Metal Poles: Provide ground lug, accessible from handhole or transformer base.

## **2.5 ACCESSORIES**

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

- C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

### **3.2 PREPARATION**

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

### **3.3 INSTALLATION**

- A. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of luminaires provided under this section.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install products in accordance with manufacturer's instructions.
- D. Install luminaires in accordance with NECA/IESNA 501.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Provide required seismic controls in accordance with Section 26 05 48.
- G. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- H. Recessed Luminaires:
  - 1. Install trims tight to mounting surface with no visible light leakage.
  - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
  - 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- I. Suspended Luminaires:
  - 1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
  - 2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
  - 3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.
  - 4. Install canopies tight to mounting surface.

5. Unless otherwise indicated, support pendants from swivel hangers.
  - J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
  - K. Pole-Mounted Luminaires:
    1. Maintain the following minimum clearances:
      - a. Comply with IEEE C2.
      - b. Comply with utility company requirements.
    2. Foundation-Mounted Poles:
      - a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 30 00.
        - 1) Install anchor bolts plumb per template furnished by pole manufacturer.
        - 2) Position conduits to enter pole shaft.
      - b. Install foundations plumb.
      - c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
      - d. Tighten anchor bolt nuts to manufacturer's recommended torque.
      - e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
      - f. Install anchor base covers or anchor bolt covers as indicated.
    3. Embedded Poles: Install poles plumb as indicated.
    4. Grounding:
      - a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
      - b. Provide supplementary ground rod electrode as specified in Section 26 05 26 at each pole bonded to grounding system as indicated.
    5. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
    6. Install non-breakaway in-line fuse holders and fuses complying with Section 26 28 13 in pole handhole or transformer base for each ungrounded conductor.
    7. Install weather resistant GFI duplex receptacle with weatherproof cover as specified in Section 26 27 26 in designated poles.
  - L. Install accessories furnished with each luminaire.
  - M. Bond products and metal accessories to branch circuit equipment grounding conductor.
  - N. Install lamps in each luminaire.
- 3.4 FIELD QUALITY CONTROL**
- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
  - B. Inspect each product for damage and defects.

- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by LP Consulting Engineers, Inc..
- E. Measure illumination levels at night with calibrated meters to verify compliance with performance requirements. Record test results in written report to be included with submittals.

### **3.5 ADJUSTING**

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by LP Consulting Engineers, Inc.. Secure locking fittings in place.
- B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by LP Consulting Engineers, Inc..

### **3.6 CLEANING**

- A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

### **3.7 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of luminaires to LP Consulting Engineers, Inc., and correct deficiencies or make adjustments as directed.
- D. Just prior to Substantial Completion, replace all lamps that have failed.

### **3.8 PROTECTION**

- A. Protect installed luminaires from subsequent construction operations.

**SECTION 270000  
COMMUNICATIONS ADMINISTRATION**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. The work outlined in this specification section is the general administrative overview for all communications systems installed under Division 27 and Division 28.

**1.2 SCOPE**

- A. Submittals
- B. Contractor Installation Shop Drawings
- C. Warranty, Testing, and Commissioning
- D. Contractor Record Closeout Documents

**1.3 RELATED REQUIREMENTS**

- A. Division 27, Communications
  - 1. Division 27 05 00 – Common Work Results for Communications
  - 2. Division 27 11 00 – Communications Equipment Rooms and Enclosures
  - 3. Division 27 11 23 – Communications Cable Management and Ladder Rack
  - 4. Division 27 13 00 – Communications Backbone Cabling
  - 5. Division 27 15 00 – Communications Horizontal Cabling
  - 6. Division 27 16 00 – Communications Connecting Cords
  - 7. Division 27 51 23 – Intercommunications Program Systems
  - 8. Division 27 53 13 - Clocks
  - 9. Division 28 20 00 – Video Surveillance
  - 10. Division 28 31 00 – Intrusion Detection

**1.4 CODES AND STANDARDS**

COMMUNICATIONS ADMINISTRATION

27 00 00 - 1

- A. The installed system shall confirm to all California State Codes
  - 1. 2022 California Building Code (CBC)
  - 2. 2022 California Electrical Code (CEC)
  - 3. 2022 California Fire Code (CFC)
  - 4. All equipment connected to the Fire Alarm system shall have California State Fire Marshall listing(s).
- B. National Codes
  - 1. 2022 NFPA 70 – National Electrical Code
  - 2. 2022 NFPA 72 – National Fire Alarm Code
  - 3. 2022 NFPA 101 – Life Safety Code
  - 4. Americans with Disabilities Act (ADA)
  - 5. Local building codes
- C. All requirements by the authority having jurisdiction (AHJ)
- D. Telecommunications Industry Association Standards (TIA)
  - a. TIA 526-7: Single Mode Fiber Standards
  - b. TIA 526-17: Multi Mode Fiber Standards
  - c. TIA-568-D.1: Commercial Building Telecommunications Cabling Standards.
  - d. TIA-568-C.2: Balanced Twisted-Pair Telecommunications Cabling and Components Standards.
  - e. TIA-569-E: Telecommunications Pathways and Spaces.
  - f. TIA-606-C: Administration Standard for Telecommunications Infrastructure.
  - g. TIA-607-D: Generic Telecommunications Bonding and Grounding (Earthing) Requirements for Customer Premises.
- E. Audio-Visual and Integrated Experience Association (AVIXA)

COMMUNICATIONS ADMINISTRATION



- a. A102.01.2017: Audio Coverage Uniformity in Listener Areas (ACU)
- b. 10:2013 Audio-Visual System Performance Verification
- c. F501.01:2015: Cable Labeling for Audio-Visual Systems
- d. V201.01: Projected Image System Contrast Ratio
- e. F502.02:2018: Rack Building for Audio-Visual Systems
- f. A103.01: Sound System Spectral Balance
- g. A104.01: Sound System Dynamic Range

## **PART 2 PRODUCTS**

**2.1 N/A**

## **PART 3 EXECUTION**

### **3.1 SUBMITTALS**

#### **A. Products Material Submittal:**

- 1. Product data and manufacturer's installation instructions for information, communications, and technology systems electronically in PDF and XLS format, as required. The PDF shall include bookmarks for each section of the submittal.
- 2. A Microsoft Excel spreadsheet listing each item submitted as a separate row. The spreadsheet shall, at a minimum, contain the following columns:
  - a. Submittal #,
  - b. Item # (tied to PDF cut sheet)
  - c. Spec section submitted
  - d. Drawing sheet referenced
  - e. Manufacturer
  - f. Part number
  - g. Description

#### **B. Products Material substitutions**

COMMUNICATIONS ADMINISTRATION

1. If the Contractor desires to use any other brand or manufacturer of equal quality and utility to that specified, they shall make application to the District/Architect/Engineer in writing, and shall submit samples, if requested. Such application constitutes a recommendation that the Contractor:
  2. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.
  3. Will provide the same warranty for equal as for specified product.
  4. Will coordinate installation and make other changes, which may be required for work to be complete in all respects.
  5. Waives claims for additional costs, which may subsequently become apparent.
  6. The Architect/Designer/Engineer will determine whether or not the proposed material is equal in quality and utility to the material specified, and their decision shall be final.
  7. Requests for equal materials will only be considered when offered by the Contractor as required by this section
- C. Whenever in the Contract Documents any materials, products, processes, or articles are indicated or specified by the name brand of the manufacturer, or by patent or proprietary names, such specifications shall be deemed to be a measure of quality and utility or a standard and shall be deemed to be followed by the words, "or equal." It is the intent of this article to comply with Public Contract Code Section 3400.

### **3.2 CONTRACTOR INSTALLATION SHOP DRAWINGS**

- A. Contractor installation "Shop Drawings" requirements
1. The Contractor Installation Shop Drawings represent the level of system design to be provided to the District/Architect/Engineer. Contractor shall provide all additional system design work required, including:
    - a. Conduit layout and sizing.
    - b. Wire and cable layout and sizing.
    - c. Point-to-point wiring and equipment hook-up information.

COMMUNICATIONS ADMINISTRATION

- d. Equipment mounting details.
    - 1. Design of equipment cabinets, including front rack elevations with accurate equipment rack unit spacing and equipment schedules.
    - 2. MDF / IDF room wall elevations for all systems, junction boxes, wall mounted equipment, power outlets etc., mounted on each wall.
    - 3. MDF / IDF room top view to show placement of equipment racks or cabinets, including required 36" clearance from mounted equipment.
  - e. Other detailed design work required.
  - f. Contractor's design shall conform to all applicable codes and ordinances. All electrical design, including the sizing and placement of conduit, raceways and conductors, shall be in accordance with NFPA 70: National Electrical Code, current version, unless local codes establish more stringent requirements.
  - g. Contractor's design work is subject to review and approval by the District/Architect/Engineer, Project Construction Manager.
- 2. It shall be understood that the drawings, details, and one-lines provided with the design package are diagrammatic and/or performance based. Data presented on design drawings are as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification, of all dimensions, routing, etc., by the contractor is required.
  - 3. Drawings are provided to show the intent of the design and specification and to assist the contractor in submitting a bid. Contractor is directed to make field surveys as part of his work prior to submitting systems installation shop drawings. The contractor shall make allowance in the proposal to cover whatever work is required to comply with the intent of the design and provide a fully functioning complete, operable, and integrated system.
  - 4. In case of doubt of work intended, it is the responsibility of the Contractor to request instructions from the District/Architect/Engineer prior to bid. The contractor shall be responsible for installing a complete, operable, integrated and functioning system to the Districts satisfaction.

COMMUNICATIONS ADMINISTRATION

5. Installation of the systems shall not be started until detailed contractor furnished shop drawings (in AutoCAD 2020 or similar professional drawing format) and product submittals have been approved by the designer and/or architect and if (a. Applicable, approved by the Division of the State Architect).
6. Any and all design and/or installation discrepancies, change orders, (including labor, materials, and shipping) incurred without contractor shop drawings or after contractor shop drawings have been approved shall be the sole responsibility of the contractor.
7. Any work performed without approved contractor furnished shop drawings and submittals shall not be allowed. If work performed prior to approve shop drawings, contractor will do so at their own risk.

### **3.3 WARRANTY, TESTING, AND COMMISSIONING**

#### **A. Warranty:**

1. All components, parts, and installation supplied by the contractor shall be guaranteed against defects in materials and workmanship for one (1) year from date of Notice of Completion or system acceptance, whichever falls later. Labor to repair, reprogram, or replace components shall be furnished by the contractor at no charge during the warranty period.
2. All warranty work of a minor nature shall be performed during hours when site and/or buildings are not occupied, Monday through Friday. Major warranty work, defined as, affecting more than 15% of the system, causing complete operator workstation or server failure, or work involving life safety shall be responded to within four (4) hours. Major warranty work shall be performed regardless of normal work hours or days until corrected.
3. All fiber optic data installs shall carry a Limited Lifetime warranty. This will require the contractor to certify their installers to the manufactures guidelines and submit their certifications with bid documents for the project.
4. Copper (Cat6/Cat6A) network cabling installs for this project shall carry a Limited Lifetime warranty. This will require the contractor to certify their installers to the manufactures guidelines and submit their certifications with bid documents for the project.

### **3.4 CONTRACTOR RECORD CLOSEOUT DOCUMENTS**

COMMUNICATIONS ADMINISTRATION

- A. The Contractor shall provide, at the completion of the project, Project Record Documents and furnish to the District one (1) Electronic Copy set of record drawings. The Contractor Record Closeout Documents shall be prepared in such a manner that each ASI, RFI, CCD, PCO is noted and clouded on the Contractor Record Closeout Documents.
- B. The Contractor shall provide an electronic copy of the field redline drawings in PDF format.
- C. The electronic Contractor Record Closeout Documents shall follow the following standards:
  - 1. Delivered as an electronic set of documents on a CD-R or a memory stick clearly labeled with Job Number, Bid Number and Name of Project.
  - 2. Drawing standards, such as line-types, line-weights, fonts and symbols shall be consistent with the bid set documents.
  - 3. Include text "Record Drawing" or "As Built" on all sheets.
  - 4. Include all revision deltas and clouds on all sheets.
  - 5. AutoCAD files shall adhere to the following standards:
    - a. Full drawing package in AutoCAD (AutoCAD 2020 or most current version), executable .dwg format
    - b. Include all fonts and plotting line-weights
    - c. Include all cross references
- D. The Contractor shall prepare and provide a complete Electronic Cable Book (PDF format), submitted on CD or electronically, as documentation. This cable book shall consist of the following with each section bookmarked within the PDF file:
  - 1. Title of project
  - 2. Index page detailing the sections
  - 3. Site plans (Record set redlined drawings on original full-size bid set plans, hard and soft copy)
  - 4. The drawings shall depict, at a minimum, the following conditions:
    - a. Division 27 systems as applicable

COMMUNICATIONS ADMINISTRATION

- E. Final inspection will not be made until drawings are received and approved. Record Drawings shall include "As-Built" one-line and wiring diagrams, with terminations identified, wire color coding schedule, pull box locations, and conduit routing plans.
- F. Warranty certificates and documentation.
  - a. One (1) Year workmanship warranty
  - b. Limited Lifetime manufacturer warranty for Fiber Optic plant.
  - c. Limited Lifetime manufacturer warranty for Cat6/Cat6A copper plant.

**END OF SECTION**

**SECTION 270500  
COMMON WORK RESULTS FOR COMMUNICATIONS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. The work of this Section consists of basic materials and methods for all communications, technology, security, access control pathways work included under Division 27 and Division 28. Additional specification requirements for electrical work are specified under other sections of Division 26 and where those requirements differ from the requirements of this section, the more stringent shall govern.

**1.2 RELATED REQUIREMENTS**

- A. Division 01 00 00 specifications, General Requirements
- B. Division 26 specification sections, as applicable
- C. Division 27 specification sections, as applicable
- D. Division 28 specification sections, as applicable

**1.3 CODES AND STANDARDS**

- A. See specification section 27 00 00 for requirements

**PART 2 PRODUCTS**

**2.1 GENERAL**

- A. All products used on this project shall bear the label and be approved by Underwriters Laboratories "UL" unless otherwise approved in writing by the District/Architect/Engineer.
- B. Any modification that voids the equipment's UL listing is strictly prohibited (i.e. relocated or oversize knock-outs).
- C. Any modified new equipment that voids the UL listing shall be replaced by the Contactor (parts and labor) at their expense.
- D. All products shall be new and unused and shall be of manufacturer's current and standard production.

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 1

- E. Where two or more equipment items of the same kind are provided, all shall be identical and provided by the same manufacturer.
- F. Drawings and specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory operation.
- G. Product Availability:
  - 1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
  - 2. Certain products specified may only be available through factory authorized dealers and distributors. Contractor shall verify his ability to procure the products specified prior to submitting a proposal.
  - 3. Equipment shortages, all equipment and material shall be ordered upon District/Architect/Engineer and design professional approval of product submittals and contractor shop drawings. The contractor shall immediately notify the District/Architect/Engineer of any long lead or backordered items so an alternate substitution may be reviewed for approval prior to ordering.

## **2.2 RACEWAYS**

- A. Rigid Steel Metallic (GRC): Full weight with threaded fittings conforming to industry standards. Rigid steel conduit in contact with earth or in concrete slabs must be PVC wrapped.
  - 1. Rigid Steel Conduit: Protected inside and outside by galvanizing or sherardizing. By Triangle, Western Pipe & Tubing, Republic or approved equal. Risers and 90-degree elbows shall be wrapped with 3M Scotchwrap 51 PVC-based tape and 3M pipe primer (cover exposed threads and couplings).
- B. Electric metallic tubing (EMT): Protected inside and outside by galvanizing or sherardizing. Minimum diameter size for EMT is  $\frac{3}{4}$ " and maximum diameter is 4". Same manufacturers as for rigid steel conduit. All fittings by: Thomas & Betts, Steel City, Raco, OZ/Gedney, or approved equal.

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 2



- C. Flexible conduit: All Flex, American Flexible Conduit, or approved equal. Where exposed to weather use liquid-tight flexible conduit, type UA complete with waterproof fittings. American Flexible Conduit, Electri-Flex, Sealtite, Anaconda, or approved equal.
- D. PVC conduit: Schedule 40 polyvinyl chloride high density, high impact, type two with factory-made bends, couplings and fittings, as manufactured by Carlon, PW Pipe, Cantex, or approved equal. Use of PVC is subject to local utility company having jurisdiction.
- E. Raceway Fittings:
  - 1. Rigid Steel Conduit (GRC): Fittings, such as couplings, connectors, conduit bodies, elbows, bends, etc., shall be subject to same requirements as for rigid steel conduit. Couplings and unions shall be threaded type, assembled with anti-corrosion, conductive anti-seize compound at joints, and made absolutely tight to exclude water. Unions shall be equal to Crouse-Hinds UNY, UNF or approved equal.
  - 2. EMT: Fittings for indoor use: couplings and connectors 3/4" and larger shall be steel setscrew type or threaded compression type. 3/4" and larger, and all outdoor applications shall be compression type. All connectors must have insulated throats.
  - 3. Flexible Metallic Conduit: Angle wedge type with insulated throat.
  - 4. Bushings: Metallic insulated type. Weatherproof, liquid-tight, dust-tight installations with sealing ring and insulated throat, Crouse-Hinds, OZ/Gedney type "KR".
  - 5. Expansion and Deflection Fittings: OZ/Gedney, Type "DX" or accepted equal.
- F. All multi-channel non-metallic surface mounted raceways shall be three compartment 5500 Wiremold by Legrand or approved equal - color to be ivory or as selected by the District/Architect/Engineer. Provide all components necessary to complete the work.
  - 1. 5500WC- Wire Clip to be installed every 24"
- G. All small single or dual channel non-metallic surface mounted raceways shall be 2300 Wiremold by Legrand, type and size specified in the drawings or approved equal - color to be ivory or as selected by the

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 3

District/Architect/Engineer. Provide all components necessary to complete the work.

1. Components include, but are not limited to:

- a. Base
- b. Cover
- c. Surface mount box
- d. Tee fitting
- e. 90 flat elbow, inside, outside fittings
- f. Entrance End Fitting
- g. Blank End Fitting
- h. Transition Fitting
- i. Cross-over Fitting
- j. Wire Clip to be installed every 24"

## **2.3 BOXES**

- A. Galvanized one-piece or welded pressed steel type. Boxes for fixture shall not be less than 4" square and shall be equipped with fixture stud. Boxes shall be at least 2-1/8" deep, 4" square for 1 or 2 gang devices, with plaster rings and gang box with gang cover. Boxes mounted in wall or ceiling finished with gypsum board shall be furnished with plaster rings. Use screws and not nails to support outlet boxes. Boxes in unfinished areas, installed exposed, shall be cast metal type for switches and convenience outlets. Provide blank cover for all boxes without fixture or device.
- B. Interior Junction boxes, larger than 8" square, located indoors shall be NEMA rated, with hinged door and an Allen key type lock kit.
- C. Exterior Junction boxes, larger than 8" square, located outdoors, or in wet or damp locations shall be rated NEMA-3R, with hinged door and cylinder lock kit keyed to match the site's master key.
- D. Floor boxes shall be one-gang or multi-gang recessed, fully adjustable with lids and cover plates for respective tile or carpet floor finish. For "hard" floors such

COMMON WORK RESULTS FOR  
COMMUNICATIONS

as tile or wood, the top of the cover shall be flush with the top of the finished floor. Receptacle covers shall have individual flip-lids with screw lock. Junction boxes shall have screwed on plugs.

1. Grade level or below: Watertight and concrete-tight of cast iron construction, FSR FL series, Walker 880CS series or equal.
  2. Above grade level: Concrete-tight of stamped steel construction, FSR FL series, Walker 880S series or equal.
- E. Provide and install center pin Torx tamper-proof screws for all exterior boxes and conduit bodies (i.e. LB, SLB, RLB, etc.).

## **2.4 PULL LINE**

- A. Furnish and install pull line in all new unused (empty) raceways / conduits.
- B. Furnish and install replacement pull lines in all raceways if new cables are pulled through them.
- C. All pull lines shall be:
1. Permanently tagged with identification at both ends.
  2. Minimum 1/8" diameter, or larger if so, designated on plans, braided line of polypropylene or Jet-Line #232, or approved equal line of continuous fiber polyolefin. Minimum breaking strength of 1/8 in. line: 200 lbs.

## **2.5 PRECAST CONCRETE GROUND BOXES/HANDHOLES**

- A. Ground boxes shall be size as indicated on the drawings. Design loads shall consist of live, dead, impact, hydrostatic and other loads. Live loads shall be for H-20 and/or H-20-S16-44, or as required, per A.A.S.H.O. standard specifications for highway bridges with revisions. Design loads shall be sixteen KIPS. Concrete shall be per ASTM-C-33-64. Lightweight concrete shall conform to ASTM-C-33-64T. Cement shall be Portland Cement meeting ASTM-C-150 Type II standards. Compressive strength shall be minimum 4,000 psi at 28 days.
- B. Ground boxes shall be supplied with steel edging in order to make spot welding cover lid to enclosure an option.
- C. Ground boxes (48" x 30" or larger): Pre-cast high-density reinforced concrete with end and side knockouts, pulling-in irons. Minimum 4" wall thickness

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 5

conforming to utility standards with spring assist traffic rated lids. Coordinate size of thin-wall knockouts with manufacturer for conduit entry. Acceptable manufacturers shall be Old Castle, Christy, Jensen or equal.

- D. Ground boxes (smaller than 48" X 30"): Pre-cast high-density reinforced concrete with end and side knockouts, and extension as required. Minimum 1-1/2" wall thickness. Acceptable manufacturers shall be Old Castle, Christy, Jensen or equal.
- E. Ground Box Covers: Large ground box covers conforming to utility standards with spring assist traffic rated lids shall be spring assisted traffic rated one or multi piece as required, steel checker plate, galvanized with anti-slip surface rated for parkway loading, with hold-down bolts. All boxes shall use H-20 rated traffic covers. No concrete covers shall be allowed.
  - 1. All Ground Box Covers shall be factory marked "Signal" unless drawings for marking/label indicates otherwise. Covers shall be provided with Penta Head hold down bolts.
- F. Utility ground boxes shall be per their requirements. Provide with ground rod as required.
- G. All conduits terminating in ground boxes shall be evenly spaced, squarely cut, and bell ends installed.
- H. All exterior conduits installed shall be color coded based on project standards. See project details.
- I. All new ground boxes shall be located using GPS points (decimal degrees) and documented on the As-Built drawings.

## **2.6 PENETRATIONS AND SLEEVES**

- A. All penetrations through fire rated assemblies (walls, ceilings and floors) shall be made with materials and/or sleeves that meet or exceed the fire rating of the assembly.
  - 1. Approved products: Specified Technologies, Inc. EZ-Path series, sealants, putty and pads.
- B. All penetration through non-rated partitions shall be made with conduit sleeves (see Raceway/EMT above) and sealed with draft stop material.

## **PART 3 EXECUTION**

### **COMMON WORK RESULTS FOR COMMUNICATIONS**

27 05 00 - 6

### **3.1 PATHWAYS AND RACEWAY**

- A. EMT conduit may be used at following locations:
  - 1. In dry in-wall spaces.
  - 2. In partitions other than concrete or solid masonry.
- B. In exterior locations, except as noted in 3.01.B.
- C. Rigid steel conduit and fittings shall be used for vertical risers and on top of all roofs, overhangs, walkways and canopies.
- D. All raceways installed in interior exposed locations shall be surface mounted raceway (Wiremold) by Legrand.
- E. Provide flexible connections of short length (4 foot maximum) to equipment subject to vibration or movement and to all motors. Provide a separate bonding conductor in all flexible connections, except as provided for in CEC 250-91 (b) Ex1.
- F. Portable buildings shall have weather-proof flex transition from underground to building conduits for both high/low voltage systems.
- G. Install exposed conduit run neatly, parallel to or at right angles to structural members. Maintain a minimum of 12 inches of clearance from steam or hot water pipes. All installed unistrut / strut channel supports should allow for future conduit attachments. The width of unistrut / strut channel to match the width of the closest attached junction box. See drawing details for attachment requirements.
- H. Supports: Support conduit with two-hole straps or unistrut / strut channel where shown and/or specified. Coordinate supports with architectural details. Secure to wood structure by means of bolts or lag screws, to metal by means of shallow self-tapping screws, to concrete by means of insert or expansion bolts, to brickwork by means of expansion bolts, and to hollow masonry or stucco by means of toggle bolts. Straps, expanders and shields shall be steel or malleable iron.
- I. Spacing for all EMT and rigid steel conduit supports shall be as follows unless otherwise specified in drawing details:
  - 1. Surface conduits, roof mounted:

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 7

- a. Spacing of supports shall comply with CEC Article 344, Table 344-30(B)(2) and 2022 CBC 1603A.
  - b. Construction of roof supports shall comply with roofing manufacturer's requirements.
  - c. Roof supports shall be securely fastened to the roof with a gluing system approved by the roof manufacturer.
  - d. Route conduits parallel with mechanical piping and along building lines.
  - e. Provide ground wire in conduits.
2. Surface conduit spacing and supports and unless otherwise specified or shown on drawing details:
- a. EMT – Size 3/4" to 1-1/2" – 4' maximum spacing (3 each supports per 10' conduit length) and 12" from each end of conduit at coupling, connector or 90-degree bend.
  - b. EMT – Size 2" to 4" – 4' maximum spacing (3 each supports per 10' conduit length) and 12" from end of conduit at coupling, connector or 90-degree bend.
  - c. Rigid steel – Size 3/4" to 1" – 4' maximum spacing (3 each supports per 10' conduit length) and 12" from each end of conduit at coupling, connector or 90-degree bend.
  - d. Rigid steel – Size 1-1/2" to 2" – 10' maximum spacing (1 each supports per 10' conduit length) and 12" from end of conduit at coupling, connector or 90-degree bend.
  - e. Rigid steel – Size 3" to 6" – 10' maximum spacing (1 each support per 10' conduit length) and 12" from end of conduit at coupling, connector or 90-degree bend.
- J. Do not install conduit in the "section" of concrete slabs, except for perpendicular penetrations. Refer to Structural Drawings for specific details.
- K. Conduits installed in contact with concrete or earth shall be:

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 8

1. Install PVC conduit in a 3" sand or fine earth (passed through 1/8 in. screen) envelope below ground. Provide a minimum of 3" of sand or fine earth at the bottom of the trench before laying conduits.
2. Risers, sweeps, bends greater than 30 degrees, shall be PVC-wrapped, or rigid steel conduit with a minimum inside bend radius as follows unless otherwise specified:

<u>CONDUIT SIZE (INCHES - NOMINAL)</u>	<u>MINIMUM BENDING RADIUS (TIMES CONDUIT SIZE)</u>
2" AND SMALLER	6" INCH
2" – 4"	24" INCH

1. When installing underground conduits to specified depth, depth shall be taken from the top of the conduit to the finished grade level. Unless otherwise specified, underground conduits shall be installed with top side not less than 24" below finished grade except that utility company primary conduit shall be 30" minimum below finished grade or as required to meet utility company standards. All conduits inside foundation line shall be not less than 2" below sub grade.
  2. The minimum size of conduits outside the foundation line shall be 1", 3/4" inside the foundation line.
  3. Place two 3" wide fluorescent orange non-biodegradable plastic tapes on both sides of trench at 12" below grade, labeled "CAUTION FIBER OPTIC LINE BURIED BELOW". Tape shall be continuous for full length of trench.
  4. Contractor shall install a #10 insulated wire at the same depth as the underground conduits. The #10 insulated wire shall be continuous for full length of trench and terminated on unistrut / strut channel at the riser or grounding strip at ground box.
- L. Above ground conduits shall have a minimum inside bend radius as follows unless otherwise specified:

<u>CONDUIT SIZE (INCHES - NOMINAL)</u>	<u>MINIMUM BENDING RADIUS (TIMES CONDUIT SIZE)</u>
2" AND SMALLER	6" INCH
2" – 4"	24" INCH

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 9

- M. If conduit is designated for low voltage use, no more than a total of 270 (3 ea. 90-degree bends, max.) degrees of conduit bend radius will be allowed between boxes.
- N. All junction boxes shall be connected to conduits using appropriate connecting hardware (i.e. box connectors)
- O. The use of conduit body LB, SLB or LBT fittings for information, communication, and technology systems is strictly prohibited.
- P. Clean, prepare, and paint all exposed conduit, junction boxes, unistrut, fittings and accessories except rooftop mounted rigid steel conduit to match the surface in which it is installed.

### **3.2 EXPANSION JOINTS**

- A. Provide conduit expansion fitting in each conduit run, which is mechanically attached to separate structures to relieve strain caused by shift of one structure in relation to another.
- B. Provide conduit expansion fitting in each conduit run wherever it crosses expansion joint in structure to which it is attached.
- C. Provide expansion fittings where expansion and contraction are a consideration in long runs of exposed conduits (one inch [1"] or larger conduit in excess of one hundred feet [100']).

### **3.3 PROOFING**

- A. Before pulling any conductors into a PVC conduit, the conduit shall be first be proofed by pulling through a mandrel of a diameter ¼ in. smaller than the conduit inside dia., followed by a swab of the same diameter as the conduit inside diameter. Proofing will be done in the presence of Construction Manager for verification.

### **3.4 SURFACE MOUNTED RACEWAYS**

- A. Surface mount non-metallic raceways shall be used as required to provide communications cabling services as shown on installation drawings.
- B. The Contractor will provide and install all surface mounted non-metallic type raceway and appropriate fittings to provide a safe and complete installation. All installation must meet manufacturers recommended installation procedures.

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 10



- C. All non-metallic raceway boxes, bases, covers and fittings shall be of the same manufacture.
- D. Wire management clips shall be installed in all raceways (vertical and horizontal runs) on maximum of 24" on center spacing. If utilizing existing raceway for new wires, wire management clips shall be installed.
- E. The non-metallic raceway components shall meet all of the CEC applicable articles.
- F. Multiple channel surface mounted raceways shall be color-coded and marked with a permanent marker on the inside of the channel and across the entire length of the channel blue for data, telephone, and IPTV and red for power. These color-coded channels shall be installed consistently with the same relative position of color on the top and the bottom throughout the site in accordance with CEC Article 352-26.
- G. The non-metallic raceway may have a factory-applied adhesive for mounting to the substrate. The contractor shall not use the factory-applied adhesive, instead the Contractor shall fasten raceways every 16" on center to studs wherever possible utilizing appropriate fastening methods by the manufacturer. The contractor shall use pan head type screws, sized in accordance with the manufacturer installation instructions. In addition to the manufactures mounting instructions, mounting hardware and anchor types recommended for any raceway that shall be mounted to the building or structure.
  - 1. Sheet rock / drywall / wall board: by means of Easy Anchor, toggle bolt, other spread type anchor with load distribution, or approved equal.
  - 2. Concrete / cinder block / solid masonry: by means of expanding compression type lag, expanding compression type bolt, expanding compression type all tread with nuts, or approved equal.
  - 3. Tile / Stucco / hollow masonry: by means of toggle bolts or approved equal.
  - 4. Wood: by means of lags, pan head wood screws, or approved equal.
  - 5. Metal: by means of a clamp, self-tapping pan head screw, or approved equal.
- H. The raceway is to be manufactured of rigid PVC compounds. The cover shall have a matte texture.

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 11

- I. A full complement of fittings must be available including, but not limited to, extension boxes, 90-degree elbows, tees, inside corners, outside corners, fixture boxes, wire clips, and device boxes. All fittings must match the color of the raceway cover.
- J. The raceway and all system components must be UL Listed and exhibit non-flammable self-extinguishing characteristics.
- K. At locations where raceway is mounted below 48 inches from the finished floor the contractor shall install a device bracket every 30" on center throughout the entire length of the raceway system. Any unused slots on the device bracket shall have a blank plate installed.
- L. Do not use pulling means, including fish tape, cable or rope, which can damage the non-metallic surface raceway.
- M. Raceway shall not have covers installed until fastening and cabling is approved by the inspector of record.

### **3.5 POWER AND COMMUNICATION POLE**

- A. In areas with system furniture and/or office furniture is set up in open areas, the cables shall be routed through an existing power pole, or a contractor supplied and installed power pole from the ceiling space to the floor.
- B. Power pole shall be properly anchored to the ceiling and the floor using the recommended mounting instruction from the manufacture.
- C. Contractor may utilize an existing power pole provided fill capacities are not exceeded.
- D. Project manager or District/Architect/Engineer representative shall determine how system furniture areas will need to be fitted with a power pole device.
- E. In the event that a power pole is not in place to serve the specific systems furniture area, the contractor is required to provide and install one.
- F. Contractor shall obtain clarification if method of installation is unclear regarding how a power pole will be installed prior to submission of contractor's bid.
- G. Where cables pass through a hole in the pole, the contractor shall provide and install a grommet around the hole in the power pole to protect the wire and cable. The grommet will be fitted with either a plastic or rubber shutter device that provides a tight seal around the wire and cable. In addition, the contractor

COMMON WORK RESULTS FOR  
COMMUNICATIONS

shall provide and install a spiral wrap type plastic device, which shall serve as a protected raceway from the power pole to the system furniture. The contractor shall then route the cables into the systems furniture raceways to the designated point of attachment at each drop location.

- H. The contractor will terminate the wire and/or cable on the device outlets, which will be installed in the appropriate manner for the type of furniture being installed.

### **3.6 FLOOR MONUMENTS**

- A. Contractor shall provide and install approved floor monuments in those areas that cables are routed below the floor space and or require termination of a drop outlet in an open area that cannot be served either by a fixed wall or power pole.
- B. Contractor shall provide all necessary labor and materials to saw cut floor, core holes and patch substrates/surfaces necessary to accommodate the installation of a floor monument.
- C. Contractor shall provide and install a floor monument as specified in construction documents.
- D. Where cables pass through a hole in the monument, the contractor shall provide and install a grommet around the hole in the power pole to protect the wire and cable. The grommet will be fitted with either a plastic or rubber shutter device that provides a tight seal around the wire and cable. In addition, the contractor shall provide and install a spiral wrap type plastic device, which shall serve as a protected raceway from the monument to the system furniture. The contractor shall then route the cables into the systems furniture raceways to the designated point of attachment at each drop location.
- E. The contractor shall then route the cables into the systems furniture raceways and/or office furniture setup in open areas to the designated point of attachment at each drop location. The contractor will then terminate these cables on device outlets which will then be installed in a high-profile box, which will be surface mounted to the underside of the work surface at each location.

### **3.7 EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES**

- A. Excavating, backfilling and compacting for conduit, underground pull boxes, vaults and other underground electrical and low voltage utilities shall be

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 13

performed in accordance with Specification Section 31 00 00 (Earthwork) for Utilities and the Geotechnical Engineering Consultant.

### **3.8 CONDUIT CAPPING**

- A. Cap conduits during construction with manufactured seals. Swab out conduits before wires are pulled in.
- B. Cap all empty conduits below grade and in pull boxes with manufacturer's caps to prevent entrance of debris, attach pull string to cap.

### **3.9 CONDUIT PENETRATIONS**

- A. Penetrations through walls, ceilings, or floors.
  - 1. Wood, stucco, drywall, and hollow masonry
    - a. Scanning for structural members and wall studs:
      - 1. Contractor shall scan the wall for studs and metal using an electronic stud finder to avoid drilling through a structural member.
      - 2. If the contractor is unsure of the building's structural supports, the contractor shall notify the inspector of record and/or project manager to confirm the location before drilling.
  - 2. Drilling
    - a. A pilot hole not exceeding 3/8" diameter shall be drilled through the material for each penetration to confirm placement of penetration on both sides of the wall and before using an auger bit or hole saw to finalize penetration size.
    - b. Final penetration sizes shall take into account the size of the conduit to be installed including box connectors if EMT and angular space requirements for fire or draft stopping.
  - 3. Concrete, brick, and solid masonry
    - a. X-ray scanning

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 14

1. Contractor shall perform or hire out to have each location of each wall penetration x-rayed to confirm the locations of rebar and other structural steel supports.
  2. If the contractor is unsure of the building's structural supports, the contractor shall notify the inspector and/or project manager to confirm the location before drilling.
- b. Core boring/ Drilling
1. Contractor shall notify the inspector and/or project manager of the time the core boring/drilling will be performed.
  2. The contractor shall save all removed material from wall for inspection. Contractor shall take precautions to protect site property from water and debris created by core boring.
  3. Final penetration sizes shall take into account the size of the conduit to be installed including box connectors if EMT and angular space requirements for dry packing.
- c. Filling angular space / dry packing
1. Contractor shall fill the angular space between the conduit and the wall with structural grout. The grout shall be even and uniform all the way around the conduit with no gaps or voids.
- B. Where conduit passes through walls, ceilings, or floors with connection points to junction boxes or raceway mounted to the same wall as the penetration provide rigid steel or IMC conduit treaded on both ends and secured in place with locking rings on both sides. Bend radius requirements shall be maintained where penetrations are made through the back of raceways; junction boxes with adequate depth shall be installed in order to comply with this requirement.
- C. Where conduit passes through walls, ceilings, or floors with connection points to junction boxes or raceway not mounted to the same wall as the penetration provide EMT conduit and secured in place with unistrut / strut channel. Box connectors shall always be used to connect EMT to junction boxes and raceways.
- D. Where conduit passes through walls, ceilings, or floors with no connection points to junction boxes or raceway provide rigid steel or IMC conduit treaded

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 15

on both ends and secured in place with locking rings and large reducing washers on both sides.

- E. Where conduit passes through finished walls or ceilings, provide steel escutcheon plates, chrome or painted, as directed. Conduit, which penetrate floor slabs, concrete or masonry walls shall be grouted and sealed watertight at penetrations.
- F. Fire stopping:
  - 1. Seal all conduit penetrations through fire rated walls and floors fire and smoke tight in conformance with 2022 CBC Sections 714 & 2022 CEC 300-21.
- G. Draft stopping:
  - 1. All non-fire rated walls must be draft stopped and sealed. Submit method to be used for approval by inspector and/or project manager. Mineral wool is one product that may be used.
- H. Water stopping:
  - 1. All exterior penetrations shall be sealed watertight. The contractor shall use silicon rubber caulk or other approved methods and materials. Submit method and material with inspector and/or project manager.
- I. Provide 12" vertical and horizontal clearance for conduit risers through roofs. Coordinate with roof manufacturer to seal roof.

### **3.10 DEMOLITION**

- A. Any existing equipment and cable noted to be removed on design plans or abandoned devices and conduit not being reused by this project shall be removed by the Contractor.
- B. Removed equipment shall be inventoried and turned over to the District/Architect/Engineer or disposed of per the project's instructions.
- C. Disturbed surfaces shall be repaired to match original surface condition and prepped for painting.
- D. Blank electrical plates colored or painted to match existing surfaces shall be installed over abandoned flush mounted device boxes.

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 16

### **3.11 BOXES**

- A. Screws shall be used to attach boxes, and must be accurately placed for finish, independently and securely supported by adequate wood backing or by manufactured adjustable channel type heavy-duty box hangers. Boxes with metal box hangers shall be attached to metal studs. Box hangers shall be securely tied or welded (where permitted) to metal studs. Paint weld with rust inhibitor. Boxes installed in masonry tile or concrete block construction shall be secured with auxiliary plates, bars or clips and be grouted in place.
- B. Locate outlets at the following heights above floor to the center of the device or handle unless otherwise noted on Drawings, Specifications, 2022 CBC 11B-308 or as required to meet ADA handicap requirements.
  - 1. Convenience Outlets: 18" AFF (6" above counter or splash not to exceed 40" above finished floor).
  - 2. Telephone Outlets: 18" AFF (45 in. for wall phone).
- C. Install pull boxes as required in accessible spaces but do not install in finished areas unless approved by the District/Architect/Engineer.
- D. Outlet boxes on opposite sides of wall requiring protected openings shall be separated by a horizontal distance of twenty-four (24") inches, Title 24 Part 2, 713.3.2 Exception #1.
- E. For sound control, separate outlets on opposite sides of walls 16" minimum. Where outlets are less than 16" or in sound rated walls, seal airtight with fire rated sheet putty pads. Fill gap between junction box and wall with acoustical sealant all around perimeter of junction box. Fill conduits larger than 1 1/4" with fire rated putty.
- F. Installation of conduit and outlet boxes in fire-resistive walls and partitions shall comply with Title 24, Part 2, Section 713.
- G. Installation of conduit and outlet boxes in fire-resistive floors, floor-ceiling or roof-ceiling assemblies shall comply with Title 24, Part 2, Section 713.

### **3.12 GROUNDING AND BONDING**

- A. Ground fittings shall be UL approved for each application as installed, installed and connected to system in accordance with 2022 CEC Code requirements.

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 17

- B. Neutral conductors and non-current carrying parts of equipment at each installation shall be grounded in accordance with applicable code. Ground conductor shall be copper having a current capacity in accordance with CEC Section 250.
- C. All equipment cases, motor frames, etc. shall be completely grounded to satisfy requirements of CEC. Install bond wire in flexible conduit. Install copper bond wire, sized in accordance with CEC, in all nonmetallic raceways and bond to all metallic parts using approved fittings.
- D. Service ground conductor shall be connected to a "Ufer" encased ground and bonded to the cold-water pipe system.
- E. Ground resistance of made electrodes shall not exceed 25 ohms, per CEC Article 250-84. Perform ground resistance test prior to connection.
- F. All connections shall be made with solder less connectors or molded fusion-welding process. Solder less connections shall be made to conform to Code requirements or manufacturers requirements if more stringent.
- G. Provide ground wire in all rooftop conduits.

### **3.13 FIELD TESTING**

- A. General: Perform field test in the presence of the District's Representative except as otherwise specified. Provide required labor, materials, equipment and connections to perform tests. Document results and submit them to the District's Representative. Repair or replace all defective work.
- B. Perform Megger test on all grounding legs:
  - 1. Notify the District/Architect/Engineer when installed cable is ready to be tested.
  - 2. Apply Megger tests. Supply labor, materials and test equipment required to perform continuity checks and Megger tests. Submit test data for approval.
  - 3. If any failure is detected, locate failure, determine cause and, as directed by the District/Architect/Engineer, replace or repair cable or conductor to satisfaction of the District/Architect/Engineer at no increase in Contract Sum.

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 18



4. Subject feeder cables rated 600 volts AC to one (1) minute withstand test, or until stable reading is obtained with 1000-volt Megger. Provide written report of Megger test results. Test report to include all test conditions.
5. Do not Megger test any cables after connecting test equipment, unless specifically directed to do so by the District/Architect/Engineer.

### **3.14 CLEANING, PATCHING, AND PAINTING**

- A. Brush and clean work prior to concealing, painting and acceptance. Performed in stages if directed.
- B. Clean and repair soiled or damaged painted exposed work and match adjoining work before final acceptance.
- C. Remove debris from inside and outside of material, equipment and structures.
- D. All conduit, connectors, j-boxes, and accessories shall be painted white with primer.
- E. All mud-rings shall be color code painted for inspection.

### **3.15 CABLING INSTALLATION AND DISTRIBUTION**

- A. Cable shall be routed in appropriate conduit by system type as outlined in details. Contractor is to contact District/Architect/Engineer representative when this requirement can't be met.
- B. Cable shall not be exposed at any point in the cable path. Contractor is to use appropriate pathway for the situation (i.e. above drop ceiling, inside wall, conduit, or non-metallic surface raceway).
- C. Cables shall be protected and sleeved with a conduit in locations where cables need to pass through walls, floors, or hard ceilings. Contractor shall install rigid steel or IMC conduit threaded on both ends and secured in place with locking rings and large reducing washers on both sides. Bend radius requirements shall be maintained where penetrations are made through the back of raceways; junction boxes with adequate depth shall be installed in order to comply with this requirement. The fire rating of the wall must be maintained during and after installation.
- D. At solid wall locations such as plaster, brick, concrete, cinder block, tile, reinforced concrete, Contractor will provide and install surface mounted

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 19

non-metallic raceways or equivalent. The use of different series raceways is required at locations where cable fill capacities are exceeded.

- E. Cables will be run vertically inside the wall and into the ceiling space. Terminations on stud walls will be accomplished with cut-in type electrical boxes with a 1" conduit (flex or EMT) extended from the box within the wall to ceiling access space.
- F. Cables routed above drop ceilings shall be run in corridors wherever possible in order to avoid furniture and work areas so that access to the cables is unencumbered.
- G. The cables are to be as accessible as possible, placed above all other items in the ceiling, including ducts and supports.
- H. Service loops:
  - 1. Service loops in Ground boxes and J-boxes shall not be installed unless with prior written approval or to allow for the minimum bend radius specified by the manufacturer:
  - 2. Cables routed above drop ceilings shall be run in corridors wherever possible in order to avoid furniture and work areas so that access to the cables is unencumbered.
  - 3. Fiber feeder cable:
    - a. Shall be a minimum of 10' at all MDF and IDF locations.
    - b. Shall be routed around the perimeter of the ground box as cable exits and enters each side of the ground box. No visible service loop required. Cable shall be secured to the side of the ground box and not rest on the bottom of the box.
  - 4. Intercommunications feeder cables:
    - a. Shall be routed around the perimeter of the backboard in which it is terminated on.
    - b. Shall be routed around the perimeter of the ground box as cable exits and enters each side of the ground box. No visible service loop required. Cable shall be secured to the side of the ground box and not rest on the bottom of the box.

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 20

5. Twisted Pair Category 6/6A cable:
  - a. Shall be a minimum of 6' at all MDF and IDF locations.
  - b. Shall be routed around the perimeter of the ground box as cable exits and enters each side of the ground box. No visible service loop required. Cable shall be secured to the side of the ground box and not rest on the bottom of the box.
  - c. Shall be a minimum of 9" behind each station location.
6. Service loops, Intercommunications:
  - a. Horizontal cables:
    1. Shall be a minimum of 3' at all head end termination locations.
    2. Shall be a minimum of 12" behind each speaker.
    3. Feeder/Backbone cables shall be routed around the perimeter of the backboard in which it is terminated on.
  - I. The cables are to be as accessible as possible, placed above all other items in the ceiling, including ducts and supports.
  - J. Do not use pulling means, including fish tape, cable or rope, which can damage the non-metallic surface raceway.
  - K. Use pulling compound or lubricant, with prior District/Architect/Engineer approval, only when necessary.
  - L. Pulling compound shall be a water base pulling lubricant that will not deteriorate cable or conduit.
  - M. Cables shall not be pulled across sharp edges. If sharp edges are present a small sleeve, insulating insert, or grommet shall be installed to protect the cable.
  - N. Cables shall be pulled free of sharp bends or kinks.
  - O. Cables shall not be forced or jammed between metal parts, assemblies, etc.
  - P. Cables shall not be pulled across access doors and pull box covers. Access to all equipment and systems shall be maintained.

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 21

- Q. Manufacturer's specifications for pulling stress and minimum bend radius shall not be exceeded on any cable.
- R. Install or replace pull-string after installing cable in any EMT, IMC, Rigid, or PVC conduits.
- S. A maximum fill capacity of 40% will be deemed acceptable for conduits and 75% of raceway and surface pathway. Contractor shall inform District/Architect/Engineer / District/Architect/Engineer representative in writing if this requirement cannot be met. If the Contractor fails to inform the District/Architect/Engineer or its representative, any labor involve in rerouting cables in such conduit or raceways shall be the sole responsibility of the Contractor
- T. Cable shall be identified with a machine-printed tag identifying the system type, source or head end location, and destination location in all access points (i.e. junction boxes, ground boxes, MDF, IDF's, etc.) and as they enter or exit the conduit pathway.
- U. Contractor will assess whether or not the ceiling space is a plenum air return, which shall dictate the use of the listed plenum type or PVC type cable required in the materials specification section. Any cable installations that shall be pulled through underground conduit will require Outside Plant (OSP) cable. OSP cable are limited to a length of 50' inside a building.
- V. Power feeds of greater than 220 volts shall not be run parallel to UTP, Speaker or other system cables. Parallel runs of greater than 20 feet require a minimum separation distance of 3 feet, or 18 inches if cables are contained in a metallic conduit, which is grounded.
- W. All power feeds crossing the path of UTP, Speaker or other system cables at right angles shall be a minimum of 6 inches in distance from the UTP cables.
- X. There shall be a 6-inch separation between the cables and the light fixtures and motors. Contractor will notify the District/Architect/Engineer or it's representative in the event this requirement cannot be met.
- Y. All cable/cablings shall be kept 6 inches away from any heat source, i.e., HVAC ducting, steam valves, etc.
- Z. Fiber Optic cable/cables shall be identified with a tag identifying cable type, destination and origin, and date installed, every 30 feet when installed in open trays or suspension systems in ceilings.

COMMON WORK RESULTS FOR  
COMMUNICATIONS

27 05 00 - 22

- AA. Station Cable (UTP) or (STP) runs are not to exceed 290 feet.
- BB. Cable splicing at any point of any cable installed by the contractor is unacceptable without specific District/Architect/Engineer and designer approval.
- CC. No cabling is allowed to rest on any ceiling tile or suspension system unless specifically authorized by the District/Architect/Engineer. Strapping or mounting to any existing wires (e.g., lighting, ceiling grid, conduits, etc.) is not permitted.
- DD. Cables, regardless of classification, shall not be bundled in larger quantities than 24.
- EE. Cables bundled in quantities of 24 or larger shall be securely mounted to building structure (i.e. stud, beam, or other framing member.) with Contractor supplied cable tray unless otherwise specified on design drawings and details.
- FF. Cables bundled in quantities less than 24 shall be securely mounted to building structure (i.e. stud, beam, or other framing member.) with Contractor supplied J-hooks every 4 feet unless otherwise specified on design drawings and details.
- GG. Cables bundled in junction boxes shall be neatly routed and secured to box with Contractor supplied Velcro straps typically 4 per box.
- HH. Cables shall be securely supported to building structure (i.e. stud, beam, or other framing member.) within 12 inches of any conduit or raceway entrance or exit. Cable tray may be required if not noted on plans.
- II. Contractor will place all UTP, Speaker and other system cables in the ceiling area on Contractor supplied and installed wire hangers or in floor spaces and raceways. Cable tray may be required if noted on plans.
- JJ. Insulation shall be removed to expose shielding and conductors/fibers to the exact length required by manufacturer for proper termination of plugs, pins and fiber terminations.
  - 1. Wires and shielding shall not be nicked or damaged in any way upon termination of pins and closure of plug assembly.
  - 2. Pins and plugs, upon termination, shall not be damaged in any way.

## **END OF SECTION**

## **COMMON WORK RESULTS FOR COMMUNICATIONS**

27 05 00 - 23

**SECTION 271100  
EQUIPMENT ROOMS AND ENCLOSURES**

**PART I GENERAL**

**1.1 SUMMARY**

- A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, tests and services to install all required components to provide a comprehensive equipment room and / or equipment enclosure, including complete cable ladder system or cable tray system. Cable ladder and tray will be used for cable management inside the equipment rooms, server rooms, and above accessible ceilings. Contractor shall determine product availability and delivery time and shall include such considerations into his proposed Contract Time. Equipment rooms are defined as data MPOE, MDF / IDF, Access Control "ACP", Intrusion Alarm "ICP" Control panel head end and other communication head end equipment.

**1.2 SCOPE**

- A. The work will include but not be limited to the following objectives:
1. For new construction – provide, coordinate, and install all required components and accessories as outlined in the design documents for a complete and operable system.
  2. For existing construction – provide, coordinate, and install all components and accessories as outlined in the design documents to modify the existing system while maintaining compliance and to seamlessly integrate the new components into the existing campus' system.
  3. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship. Contractors unfamiliar with the District's standards shall familiarize themselves with the District's standards and requirements prior to beginning work
  4. Labor and Materials: The Contractor shall provide and pay for all labor, materials, equipment, tools, utilities, construction equipment and machinery, transportation and other facilities and services necessary for the proper execution, operation and completion of the Work.

EQUIPMENT ROOMS AND  
ENCLOSURES  
27 11 00 - 1

5. Contractor shall furnish and install all new components and hardware (active or passive) as indicated on the project drawings and/or as required to provide a turn-key system to the District.
6. Contractor shall provide and install all required fire-treated 3/4" plywood on all walls of the equipment room.
7. Contractor shall coordinate and arrange to have all required electrical installed and placed as shown on project drawings and / or where required following best practices.
8. Contractor shall coordinate with all trades for all wall mounted equipment, junction boxes and/or raceway required in the equipment room and provide actual elevations of all components on the required approved to-scale pre-installation shop drawings in order to eliminate any conflicts or clearance issues.
9. Contractor shall coordinate with all trades for all floor mounted equipment and provide actual floor elevations of all components on the required approved to-scale pre-installation shop drawings in order to eliminate any conflicts or clearance issues.
10. Contractor shall provide and install all required installed racks and cabinets.
11. Contractor shall provide a ground bus bar at each MPOE, MDF, IDF room.
12. Contractor to provide all components to furnish complete cable ladder systems. Cable ladder systems are defined to include, but are not limited to straight sections of ladder, type cable ladders, bends, tees, elbows, drop-outs, supports and accessories.
13. Contractor to provide all components to furnish complete tray systems. Tray systems are defined to include, but not limited to straight sections of tray, factory and field bends."T" fittings, drop-out fittings, supports and accessories.
14. Contractor shall set up a complete wire management system at each MDF/IDF, this includes wire management organizer(s). Contractor shall provide one horizontal wire manager for each new patch panel and one horizontal wire manager for each switch to be installed unless otherwise indicated in design drawings and details.

EQUIPMENT ROOMS AND  
ENCLOSURES

27 11 00 - 2

15. If existing MDF or IDF is in an area where construction will generate dust, the entire rack or cabinet shall be protected from dust. Extra care shall be taken to provide ventilation of the rack / cabinet if it is covered to allow air to circulate through the rack / cabinet in order for the equipment not to overheat.
16. When required per design documents uninterruptable power supplies (UPS) are to be provided, installed and configured by the Contractor.

### **1.3 RELATED REQUIREMENTS**

- A. Division 01 00 00 – General Requirements
- B. Division 27 00 00 - Communications

### **1.4 INDUSTRY GUIDELINES AND STANDARDS**

- A. ANSI/NFPA 70 - National Electrical Code.
- B. ASTM B633 - Specification for Electro-deposited Coatings of Zinc on Iron and Steel
- C. NEMA VE 1 - Metallic Cable ladder Systems.

### **1.5 QUALIFICATIONS**

- A. The contractor shall possess a California C7 or C10 license.
- B. The Contractor or Subcontractor shall be Leviton certified to provide and install cable plant with 5 years documented experience.
- C. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.

### **1.6 SYSTEM REQUIREMENTS**

- A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing data cable plan system.

### **1.7 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS**

- A. See section 27 00 00 for requirements.

### **1.8 SUBMITTALS**

EQUIPMENT ROOMS AND  
ENCLOSURES  
27 11 00 - 3



- A. See section 27 00 00 for requirements.

## **1.9 WARRANTY**

- A. Refer to Division 01 Warranty section.
- B. See section 27 00 00 for additional requirements.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- A. See Appendix at the end of this document for pre-approved materials.
- B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.
- C. Contractor shall confirm all equipment part numbers with the District prior to ordering equipment and updating submittals as required.
- D. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory installation and operation.
  - 1. Mounting hardware and anchors recommended by the Manufacture of any material that shall be mounted to the building or structure.
  - 2. Sheet rock / drywall / wall board: Easy Anchor, toggle bolt, other spread type anchor with load distribution, or approved equal.
  - 3. Concrete / cinder block / solid masonry: expanding compression type lag, expanding compression type bolt, expanding compression type all tread with nuts, or approved equal.
  - 4. Tile / Stucco / hollow masonry: toggle bolts or approved equal.
  - 5. Wood: lags, wood screws, or approved equal.
  - 6. Metal: clamp or approved equal.
- E. Product Availability

EQUIPMENT ROOMS AND  
ENCLOSURES  
27 11 00 - 4

1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
2. Subject to compliance with these specifications, products and systems included in this section 27 11 00 are to be installed as specified by the manufacturer of the system or engineer approved equal.

## **2.2 CONDUIT AND RACEWAY**

- A. See division 27 05 00 for conduit and raceway requirements.

## **2.3 LADDER RACK**

- A. In Equipment Rooms, ladder rack shall be installed to support all cable running to racks and cabinets.
- B. Ladder rack to be added to all Equipment Rooms in places where cable is run horizontally and vertically.
- C. UL Classified and Listed.
- D. Furnish and install all connectors and fittings, as required. Where cables drop out of the ladder rack, "drop-out" fittings shall be furnished and installed.
- E. Ladder rack shall be bonded and grounded according to NEC, CEC and manufacturer's recommendations.
- F. Finish: Black powder coat
- G. Ladder rack tray shall be industry standard with typical rung spacing. Rungs can be removed or repositioned to accommodate specific project or building requirements.
- H. Cable shall be bundled in a neat and workmanlike fashion in compliance with each cable type standard.
- I. All appropriate ladder rack support hardware including angle brackets, rack-to-runway brackets, wall-to-runway brackets, elevation kits, junction splices, butt splices, and grounding jumpers shall be used for a complete and professional installation.

## **2.4 WIRE BASKET**

EQUIPMENT ROOMS AND  
ENCLOSURES  
27 11 00 - 5

- A. Wire basket to be constructed with Minimum Wire Diameter of 0.196" (5.0 mm)
- B. UL Listed. Finishes are shown in part number suffix as EG (Electroplated zinc galvanized) or BLE (Black powder coat). UL/CSA Classified as an equipment ground conductor when coating has been removed at splice contact points.
- C. Wire basket shall be bonded and grounded according to NEC, CEC and manufacturers recommendations. Run appropriately sized ground wire alongside the tray and attach it to each tray section and on both sides of a cut in the tray.
- D. Use flush-cutters for cutting and bending of wire basket for smooth burr-free and snag-free cuts. Do not use bolt cutters. Use rubber caps on exposed wire ends as needed.
- E. All appropriate support hardware including corner supports, trapeze supports and brackets, splices, grounding jumpers and other parts not provided below, shall be used for a complete and professional installation.

## **2.5 BACKBOARDS**

- A. Plywood, fire-retardant treated, 3/4" by 48" by 96" inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry."
- B. Mask and protect fire rating stamp if backboard is to be painted.

## **2.6 RACKS**

- A. See Appendix A for pre-approved product.

## **2.7 VERTICAL AND HORIZONTAL CABLE MANAGEMENT, SURGE PROTECTION DEVICES, BUILDING ENTRANCE PROTECTORS**

- A. See Appendix-A for pre-approved product.

## **PART 3 EXECUTION**

### **3.1 ACCEPTABLE INSTALLERS**

- A. The components making up the equipment room and enclosures shall only be installed by Contractors who are qualified to install, service and maintain the system.

EQUIPMENT ROOMS AND  
ENCLOSURES  
27 11 00 - 6

- B. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience before the Bid Opening Date.

### **3.2 EXAMINATION**

- A. The Contractor shall be required to visit the installation site(s) prior to bidding the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to the District.
- B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

### **3.3 PREPARATION**

- A. The Contractor shall order all required parts and equipment upon receipt of approved product submittals.
- B. The Contractor shall verify the availability of power where required.

### **3.4 SHOP DRAWINGS**

- A. The Contractor shall create "Shop Drawings" per section 27 00 00.
- B. Submit drawings for review and approval by Project Manager.

### **3.5 INSTALLATION**

- A. Entrance Facilities
  - 1. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and housing when so directed by service provider.
  - 2. Install underground or aerial pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.
- B. Underground Entrance Pathway
  - 1. Install underground entrance pathway complying with Division 26 Section "Raceway and Boxes for Electrical Systems."

EQUIPMENT ROOMS AND  
ENCLOSURES  
27 11 00 - 7

2. Comply with NECA 1.
3. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
4. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

C. Equipment Racks and Cabinets

1. Backboards:
  - a. Shall be installed behind the rack or cabinet if the cabinet is not able to be directly attached to two vertical wall studs.
  - b. Backboards shall be made of fire retardant or treated materials, squarely cut, routed and sanded edges, void free and painted, leaving the fire-retardant stamp unpainted. Edges shall be sealed with manufacturing fire retardant sealant.
  - c. Backboards made from particle or pressed board materials are NOT acceptable.
  - d. Backboards shall be a minimum 3/4" thickness and large enough to secure it to two vertical wall studs.
  - e. Backboard shall be painted with white fire-retardant paint if it is installed in an occupied area. The "FIRE RATED" stamp shall be visible after painting.
  - f. Backboards shall be fastened with 1/4" lag bolt and washer, non-recessed, with maximum spacing of 18" into 2 vertical studs. Backboards mounted on the inside of the cabinets shall be squarely cut, with sanded edges and void free. Inside backboard shall match the inside dimensions of the installed cabinet. Inside backboard shall be a minimum 3/4" thickness.
2. All data and voice communications racks and cabinets shall be anchored in accordance with manufacturer specifications, project specifications and/or drawn details, to walls and floors and grounded to building ground grid (not to water pipes etc.).

EQUIPMENT ROOMS AND  
ENCLOSURES  
27 11 00 - 8

3. All floor-mounted racks and cabinets shall have ladder racking from top of rack or cabinet to nearest wall as directed by drawn details.
4. Securely mount equipment cabinet and racks to the building structure. Proper supports such as 3/8" lag screws and expansion anchors shall be used. Proper quantity of supports will be utilized. Dry wall screws and other types of supports not specifically approved to support equipment are specifically prohibited. Submit mounting supports for approval before installation.
5. Equipment cabinet mounted on or against walls shall have 3-foot (36") clearance in front to nearest wall or equipment.
6. MDF and all IDF's shall have one dedicated 220V/30A outlet (MDF only), and/or one dedicated 120VAC/20A outlet mounted above on ladder rack.
7. Patch Panels: Mount patch panels into the cabinet/rack in top-to-bottom fashion with the first patch panel (Fiber) mounted at the top of the "Active" equipment rack. Uniquely label each patch panel according to the numbering convention outlined in the SECTION on labeling. Each port will also have color-coded identifiers. Refer to details on the Drawings.
8. Cable Management: Secure the cable bundle(s) to the rack strain relief and cable management behind the patch panels and cross connect block panels. Install horizontal cable management panels and brackets for routing and management of patch cables. Maintain TIA/EIA and BICSI standards on bundling, supporting and bend radii.
9. Surge Protected Outlet Strips: Mount surge protected outlet strips per Manufacturer's directions. Refer to details on the Drawings for mounting location.
10. Contractor to place a large label to ID the rack or cabinet location. It shall be placed on the top left side of the rack or the cabinet, clearly visible from the floor. A label shall also be placed on each of the racks or cabinet's patch panel on the top left side of the patch panel (i.e. IDF 1.2).
11. If more than one cabinet or rack is located in the MDF/IDF, they will be labeled in alphabetical order (A, B, C, etc.).

D. Bonding and Grounding

1. Refer to Section 27 05 00 Grounding requirements.

EQUIPMENT ROOMS AND  
ENCLOSURES

27 11 00 - 9

2. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
3. Comply with ANSI-J-STD-607-A.
4. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
5. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
6. Retain subparagraph below if screened twisted-pair cables and coaxial cables are in communications equipment rooms.
7. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

### **3.6 WORKMANSHIP**

- A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship. Contractors unfamiliar with the District's standards shall familiarize themselves with the District's standards and requirements prior to beginning work
- B. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.
- C. Perform Work with persons experienced and qualified to produce workmanship specified.
- D. Maintain quality control over suppliers and Subcontractors.
- E. Quality of workmanship is considered important. The District's Project Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.

### **3.7 CABLE**

- A. Design, layout, size, and plan new cable runs as required.

EQUIPMENT ROOMS AND  
ENCLOSURES  
27 11 00 - 10

- B. All wire and cable passing thru metalwork shall be sleeved by an approved grommet or bushing.
- C. Conduit/raceway fill shall not exceed 40 percent of interior cross-sectional area.
- D. Neatly dress and tie all cabling.
- E. UTP cabling shall conform to a 6-foot separation requirement from the main power panel, transformers, switchgear and/or starter motors adjacent to the MDF, IDF and termination locations.

### **3.8 CONDUIT AND RACEWAY INSTALLATION, PENETRATIONS, CUTTING AND PATCHING, DEMOLITION, PAINTING AND ADDITIONAL PROJECT CONSTRUCTION REQUIREMENTS**

- A. See section 27 05 00 for requirements.

### **3.9 FIELD QUALITY CONTROL AND TESTING**

- A. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify District of your readiness to perform the formal Test & Inspection of the complete system.
- B. Submit the Record Drawings (as-builts) to District for review prior to inspection.
- C. During the formal Test & Inspection (Commissioning) of the system, have personnel available with tools and equipment to inspect wiring, devices and system operation.
- D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.
- E. Notify District when ready to perform a re-inspection of the installation.

### **3.10 AS-BUILT DRAWINGS AND TEST RESULTS**

- A. See section 27 00 00 for requirements.



**APPENDIX-A**  
**(Unless Otherwise Specified on Construction Document Plan Sheets)**

DESCRIPTION	MANUFACTURER	PART NUMBER
Cable tray, open bottom, ceiling mounted	Snake Tray	201 series ceiling mounted
Cable tray, open bottom, wall mounted	Snake Tray	501 series wall mounted
Cable tray, solid bottom, center hung style	MonoSystems	RTCX-XX-120-PX
Cable tray, solid bottom, wall mount style	MonoSystems	RTWX-XX-120-PX
Power Pole plates, QuickPort Decora Multimedia Insert	Leviton	41646-I
Blanks to cover any unused port	Leviton	41084-BIB
Wall mount face plates, 6 port. Color to match electrical plate color or raceway to be installed.	Leviton	41091-6XX
2-Port Surface Mount Box, White	Leviton	41089-2WP
2-port angled faceplate	Leviton	41081-2WP
Wiremold Legrand 5500 components include, but are not limited to:  a. 500BD-Divided Base b. 5500C- Cover c. 5507C- Device Bracket d. 5507D- Duplex Plate e. 5507B- (2)-Blank Plates f. 5510D- Entrance End Fitting g. 5500WCA- Wire Clip to be installed every 24"	Wiremold Legrand	See column to left
All small single or dual channel non-metallic surface mounted raceways shall be 2300 Wiremold by Legrand, type and size specified in the drawings or approved equal	Wiremold Legrand	2300
Power and Communication Components include, but are not limited to:  a. Rectangular Device Cover  b. 6 port QuickPort Decora Multimedia Insert  c with blanks	Wiremold Legrand  Wiremold Legrand  Leviton  Leviton	30TP 4*V (*height of pole determined by ceiling height)  p/n 30TP-L  p/n 41646-W  p/n 41084-BW

EQUIPMENT ROOMS AND  
ENCLOSURES  
27 11 00 - 12

Central Valley CHS  
Shafter, CA  
DSA Submittal - Feb. 27, 2026

## CABINETS AND RACKS

DESCRIPTION	MANUFACTURER	PART NUMBER
Wall mounted cabinets, ReBox, Light Gray	Hubbell, ReBox	RE4X Including lock set CKL333 Including fan kit REKF
Floor mounted cabinet, Pivoting, swing-out rack  Included Accessories are:  a. 1 Set Additional Mounting Rails b. Vented front door c. Zero Clearance Latch d. Vertical power strip e. Grommets f. Qty 4 - 4 ½ " fans g. Fan controller h. (2) Zero rack space mounted shelves	Middle Atlantic	SR-40-32      a. DWR-RR46 b. VFD-46 c. DWRSR-ZL d. PD-2420SC-NS e. GK-4G f. QFAN g. FC-4-1CA h. WUSS20.5
Audio-Visual floor mounted cabinets, with a minimum, of the following accessories (drawings may depict additional accessories):  a. (1 Set) Additional Mounting Rails b. (2 ea.) Zero rack space mounted shelves c. (1 ea.) Fan controller d. (1 ea.) Ganging Hardware e. (1 ea.) Brush Grommet Panel	Middle Atlantic	MRK-4431-AV      a. MV-RR44 b. WUSS20.5 c. FC-2-215-1CA d. SPN-44-312 e. BR2
Two-Post Rack, 19"W x 86"H universal Patching Frame with:  a. 12" Runway mounting kit b. Specified ladder racking with mounting hardware for structural support. c. Include two single sided shelves. d. Vertical wire management shall be installed on both sides on the rack unless shown otherwise.	Middle Atlantic	4RL10-45      a. 55105-712 b. As detailed   c. 10758-701 d. As detailed
Floor mount, 4 post adjustable Equipment / Server rack (19"x84" (45U) with cage nut rack fasteners	Middle Atlantic	R4CN-4524B

EQUIPMENT ROOMS AND  
ENCLOSURES  
27 11 00 - 13

Central Valley CHS  
Shafter, CA  
DSA Submittal - Feb. 27, 2026

**END OF APPENDIX-A**

**END OF SECTION**

**SECTION 271123**  
**COMMUNICATION CABLE MANAGEMENT & LADDER RACK**

**PART I GENERAL**

**1.1 SECTION INCLUDES**

- A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, tests and services to install a complete cable management system / cable tray system. J-Hooks, Wire Basket / Cable tray will be used for cable management inside the MDF/IDF rooms and above accessible ceilings.
- B. J-Hooks are used to support low voltage wiring to provide an easy way to manage and identified cable bundles. Cable bundles of less than 25 cables shall use J-Hooks for support.
- C. Cable ladder systems are defined to include, but are not limited to straight sections of ladder, type cable ladders, bends, tees, elbows, drop-outs, supports and accessories.
- D. Wire Basket and Tray system are defined to include, but not limited to straight sections of tray, factory and field bends."T" fittings, drop-out fittings, supports and accessories.
- E. Cable bundles of more than 25 cables shall use wire basket / tray / cable ladder system to neatly organize and support the cable bundles.

**1.2 REFERENCES**

- A. ANSI/NFPA 70 - National Electrical Code.
- B. ASTM B633 - Specification for Electro-deposited Coatings of Zinc on Iron and Steel
- C. NEMA VE 1 - Metallic Cable ladder Systems.

**1.3 DRAWINGS**

- A. The drawings which constitute a part of these specifications indicate the general route of the cable ladder and tray systems. Data presented on these drawings are as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification, of all dimensions, routing, etc., by the contractor is required.

COMMUNICATION CABLE  
MANAGEMENT & LADDER RACK

27 11 23 - 1

- B. Specifications and drawings are for assistance and guidance, but exact routing, locations, distances and levels will be governed by actual field conditions. Contractor is directed to make field surveys as part of his work prior to submitting system layout drawings (shop drawings).

#### **1.4 SUBMITTALS**

- A. Submittal Drawings: Submit elevation drawings of cable ladder and/or tray and accessories including clamps, brackets, hanger rods, splice plate connectors, expansion joint assemblies, fire stopping, and fittings, showing accurately scaled components.
- B. Product Data: Submit manufacturer's data on cable ladder and/or tray including, but not limited to, types, materials, finishes, rung spacing, inside depths and fitting radii. For side rails and rungs, submit cross sectional properties including Section Modulus (Sx) and Moment of Inertia (Ix).

#### **1.5 QUALITY ASSURANCE**

- A. Manufacturers: Firms regularly engaged in manufacture of cable ladders / trays and fittings of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. NEMA Compliance: Comply with NEMA Standards Publication Number VE1, "Cable ladder Systems".
- C. NEC Compliance: Comply with NEC, as applicable to construction and installation of cable ladder and cable tray systems (Article 318, NEC).
- D. UL Compliance: Provide products which are UL-classified and labeled.
- E. NFPA Compliance: Comply with NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance" pertaining to installation of cable ladder and tray systems.

#### **1.6 DELIVERY, STORAGE AND HANDLING**

- A. Deliver cable ladder and/or tray systems and components carefully to avoid breakage, denting and scoring finishes. Do not install damaged equipment.
- B. Store cable ladders, tray and accessories in original cartons and in clean dry space; protect from weather and construction traffic.

### **PART 2 PRODUCTS**

#### **COMMUNICATION CABLE MANAGEMENT & LADDER RACK**

27 11 23 - 2

## **2.1 ACCEPTABLE MANUFACTURERS**

- A. Manufacturer: Subject to compliance with these specifications, cable ladder systems to be installed shall be as manufactured by B-Line Systems, Inc., Chatsworth Products, Inc., or engineer approved equal. Cable tray system shall be installed as specified by the manufacturer of the system or engineer approved equal.

## **2.2 J-HOOKS**

- A. Shall be pre-galvanized steel with a minimum static load capacity of 30lbs.
- B. Shall be installed with J-Hook Color ID clips to designate system wiring.
- C. See Appendix A for pre-approved components.

## **2.3 CABLE LADDER SECTIONS AND COMPONENTS**

- A. General: Except as otherwise indicated, provide metal cable ladders, of types, classes and sizes indicated; with splice plates, bolts, nuts and washers for connecting units. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.
- B. Materials and Finish: Material and finish specifications for each cable ladder type are as follows:
  - 1. 1-1/2" Tubular Steel: Straight section and fitting side rails and rungs shall be extruded from ASTM A513 steel tube. All fabricated parts shall be finished with a black powder coat.

## **2.4 TYPE OF CABLE LADDER SYSTEM**

- A. Ladder shall consist of two longitudinal members (stringers) with transverse members (rungs) welded to the stringers. Rungs shall be spaced 9" inches on center. Rung spacing in radiused fittings shall be 9 inches and measured at the center of the cable ladder's width. Rungs shall have a minimum cable bearing surface of 1" with radiused edges. No portion of the rungs shall protrude below the bottom plane of the side rails.
- B. Straight cable ladder sections shall have side rails fabricated as tubular steel channels. All straight sections shall be supplied in standard 10'-foot lengths, except where shorter lengths are permitted to facilitate cable ladder assembly lengths as shown on drawings.

COMMUNICATION CABLE  
MANAGEMENT & LADDER RACK

27 11 23 - 3

- C. Cable ladder widths shall be 12" and/or 18" inches per drawings.
- D. Butt Splice kits shall be the bolted type made as indicated below for each cable ladder type. The resistance of fixed splice connections between an adjacent section of cable ladder shall not exceed .00033 ohm. Splice plate construction shall be such that a splice may be located anywhere within the support span without diminishing the cable ladder rated loading capacity.
  - 1. All splice materials shall be made of ASTM A570 structural steel using carriage bolts and serrated flange locknuts. Hardware shall be Yellow Zinc Dichromate.
- E. Cable ladder Supports: Shall be placed so that the support spans do not exceed a maximum span of 5' feet. Supports shall be constructed from formed shape channel members 1 5/8" x 1 5/8" with necessary hardware such as Trapeze Support Kits (9G-55XX-22SH) as manufactured by B-Line Systems or engineer approved equal. Cable ladders installed adjacent to walls shall be supported on wall mounted brackets such as SB-214 as manufactured by B-Line Systems, Inc. or engineer approved equal. Trapeze hangers shall be supported by 1/2" (minimum) diameter rods and a cover shall be installed over the threaded rod.
- F. Accessories - special accessories shall be furnished as required to protect, support, and install a cable ladder system. Accessories shall consist of but are not limited to; section splice plates, expansion plates, blind-end plates, specially designed ladder drop-outs, barriers, etc.

## **2.5 CABLE TRAY SECTIONS AND COMPONENTS**

- A. General: Except as otherwise indicated, provide metal cable trays, of types, classes and sizes indicated; with splice connector bolt, bolts, nuts and washers for connecting units. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.
- B. Materials and Finish: Material and finish specifications for each cable tray type are as follows:
  - 1. Pre-galvanized ASTM B633 SC3 steel wire: Mounting rings or snake eyes are located along the center spine for mounting.

## **2.6 TYPE OF CABLE TRAY SYSTEM**

COMMUNICATION CABLE  
MANAGEMENT & LADDER RACK

27 11 23 - 4

- A. Tray type cable trays shall consist of single spine wire with transverse members (rungs) welded to the spine. Rungs shall be spaced 6 inches minimum on center. Linear single spine tray shall be hand bendable in any direction along any plane. Tray shall be field formed as needed.
- B. Splicing of tray shall be accomplished by using a single manufacturer supplied UL classified connector bolt or splice plate.
- C. Tray shall be secured to the following, but not limited to: wall, rod, and/or floor; every 4 feet via built-in integrated mounting rings or double rail.
- D. Tray sections that are cut to meet installation requirements shall be free of burrs and sharp edges.

## **2.7      LOADING CAPACITIES**

- A. Cable ladders shall meet NEMA class designations: 8A.

## **PART 3 EXECUTION**

### **3.1      INSTALLATION**

- A. Install cable ladders and/or trays as indicated; in accordance with equipment manufacturer's instructions, and with recognized industry practices, to ensure that cable ladder or tray equipment comply with requirements of NEC, and applicable portions of NFPA 70b and NECA's "Standards of Installation" pertaining to general electrical installation practices.
- B. Install cabinets, cable ladders and/or cable trays per local codes for earthquake "zone" requirements.
- C. Coordinate cable ladder and tray with other electrical work as necessary to properly interface installation of cable ladder and tray work with other work.
- D. Provide sufficient space encompassing cable ladders to permit access for installing and maintaining cables.

### **3.2      TESTING**

- A. Test cable ladders and trays to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance. Refer to NFPA70B, Chapter 18, for testing and test methods.

COMMUNICATION CABLE  
MANAGEMENT & LADDER RACK

27 11 23 - 5



**APPENDIX-A**  
**(Unless Otherwise Specified on Construction Document Plan Sheets)**

**CABLE MANAGEMENT**

DESCRIPTION	MANUFACTURER	PART NUMBER
Cable tray, open bottom, ceiling mounted	Snake Tray	201 series ceiling mounted
Cable tray, open bottom, wall mounted	Snake Tray	501 series wall mounted
Cable tray, solid bottom, center hung style	MonoSystems	RTCX-XX-120-PX
Cable tray, solid bottom, wall mount style	MonoSystems	RTWX-XX-120-PX
Cable Hooks  A. ¾" B. 2" C. 4"	B-Line	  A. BCH12 B. BCH32 C. BCH64
J-Hook Color ID Clip:  a. Yellow (Fiber/Data) b. Orange (Clock/Intercom) c. Red (Fire Alarm/Intrusion) i. GreenLighting control wiring ii. HVAC control wiring iii. Irrigation control wiring	B-Line	  a. YW b. OR c. RD d. GRN

**END OF APPENDIX-A**  
**END OF SECTION**

COMMUNICATION CABLE  
MANAGEMENT & LADDER RACK

27 11 23 - 6

Central Valley CHS  
Shafter, CA  
DSA Submittal - Feb. 27, 2026

**SECTION 271300  
COMMUNICATION BACKBONE CABLING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This section specifies equipment, accessories, materials, installation, configuration and testing requirements for a complete and operable Communications Backbone Cabling system. The system shall provide highly reliable and high-performance data communication from main distribution frame (MDF) to each intermediate distribution frame (IDF) or end points requiring fiber optic cabling.

**1.2 SCOPE**

- A. The work will include but not be limited to the following objectives:
1. For new construction – provide, coordinate, and install all required components and accessories as outlined in the design documents for a complete and operable system.
  2. For existing construction – provide, coordinate, and install all components and accessories as outlined in the design documents to modify the existing system while maintaining compliance and to seamlessly integrate the new components into the existing campus' system.
  3. Labor and Materials: The Contractor shall provide and pay for all labor, materials, equipment, tools, utilities, construction equipment and machinery, transportation and other facilities and services necessary for the proper execution, operation and completion of the Work.
  4. The Contractor shall furnish and install all new conduit/raceway and wire as indicated on the project drawings and/or as required to provide a turn-key system to the District.
  5. The Contractor shall terminate all strands of fiber at each fiber enclosure. All cables shall be installed with a minimum 10' service loops at MDF/IDF locations. Fiber will be terminated using LC type connectors.
  6. Service loops shall be secured to backboard or rear of cabinet using a pre-manufactured fiber optic wheel with Velcro straps. If installed at rear of cabinet, the wheel shall be placed at a height that will not interfere with equipment to be installed in the cabinet.

COMMUNICATION BACKBONE CABLING

27 13 00 - 1

7. If applicable, existing systems shall remain operable until new systems are accepted and approved by the District or its representative.
  8. The contractor shall complete all required project closeout documentation in a timely fashion.
  9. Testing of fiber and connections to insure a complete and operable end-to-end data connection using ANSI/TIA 568-C and ANSI/TIA/526-7 testing guidelines for multi-mode fiber.
  10. Fiber installs to carry Leviton Limited Lifetime warranty (see Division 27 05 00 for requirements).
- B. VOICE COPPER BACKBONE- This work relates only to sites where the District has not activated a Voice over IP platform or if special circumstances requires an analog copper connection such as a fax machine, intercom connection tie-in, HVAC controller, etc. The work will include but not be limited to the following objectives:
1. MPOE
    - a. Backbone feeder cables shall be at a minimum Category 5, size and number of pairs as indicated in drawings and Scope of Work documents, but never less than 8 pairs.
    - b. All pairs are to be terminated as follows:
      1. At the MPOE end, on 66-blocks.
      2. At the MDF end, individual jack per pair, single pair per RJ45 port, housed in 4-port or larger surface mount quickport box.
  2. Buildings requiring an analog fax connection
    - a. Backbone feeder cables shall be at a minimum Category 5, size and number of pairs as indicated in drawings and Scope of Work documents, but never less than 4 pairs.
    - b. All pairs are to be terminated as follows:
      1. At the IDF end, individual jack per pair, single pair per RJ45 port, housed in 4-port or larger surface mount quickport box.
      2. At the MDF end, individual jack per pair, single pair per RJ45 port, housed in 4-port or larger surface mount quickport box.

#### COMMUNICATION BACKBONE CABLING

3. Buildings requiring an analog tie-in to the intercommunications head end unit.
  - a. Backbone feeder cables shall be at a minimum Category 5 SHIELDED cable, size and number of pairs as indicated in drawings and Scope of Work documents, but never less than 4 pairs.
  - b. All pairs are to be terminated as follows:
    1. At the IDF end, individual jack per pair, single pair per RJ45 port, housed in 4-port or larger surface mount quickport box.
    2. At the MDF end, individual jack per pair, single pair per RJ45 port, housed in 4-port or larger surface mount quickport box.

### **1.3 REQUIREMENTS**

- A. Division 01 00 00 – General Requirements
- B. Division 27 00 00 - Communication
- C. Division 27 05 00 – Common Work Results for Communication Systems
- D. Division 27 11 00 – Equipment Rooms and Enclosures
- E. Division 27 15 00 – Communication Horizontal Cabling

### **1.4 INDUSTRY GUIDELINES AND STANDARDS**

- A. ANSI/TIA-568-1.D: Commercial Building Telecommunications Cabling Standard.
- B. ANSI/TIA -568-C.2: Balanced Twisted-Pair Telecommunications Cabling and Components Standard.
- C. ANSI/TIA -568-3.D: Optical Fiber Cabling Components Standard.
- D. ANSI/TIA/EIA-569-D: Telecommunications Pathways and Spaces.
- E. ANSI/TIA -568-0.D: Measurement of Optical Power Loss of Installed Fiber Optic Cable Plant
- F. ANSI/TIA -598-D: Optical Fiber Cable Color Coding.

## **COMMUNICATION BACKBONE CABLING**

- G. ANSI/TIA -606-C: Administration Standard for Telecommunications Infrastructure.
- H. ANSI/TIA -607-C: Generic Telecommunications Bonding and Grounding (Earthing) Requirements for Customer Premises.
- I. ANSI/TIA -758-B: Customer-Owned Outside Plant Telecommunications Infrastructure Standard.
- J. Fiber optic cable, wire and connectors shall be installed as indicated, in accordance with the manufacturer's written instructions, the applicable requirements of NEC and the National Electrical Contractors Association's "Standard of Installation", and in accordance with recognized industry practices to ensure that products serve the intended functions. As such, all of the following: National Fire Code (NFPA), National Electrical Code (NEC), California Electrical Code (CEC), California Building Code (CBC) & Local Codes shall be followed.

## **1.5 QUALIFICATIONS**

- A. The contractor shall possess a California C7 or C10 license.
- B. The Contractor or Subcontractor shall be Leviton certified to provide and install cable plant with 5 years documented experience.
- C. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.

## **1.6 REFERENCES**

- A. See Division 27 00 00.

## **1.7 SYSTEM REQUIREMENTS**

- A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing data cable plan system.

## **1.8 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS**

- A. See section 27 00 00 for requirements.

## **1.9 SUBMITTALS**

- A. See section 27 00 00 for requirements.

## **PART 2 PRODUCTS**

### **COMMUNICATION BACKBONE CABLING**

## **2.1 DATA FIBER BACKBONE**

- A. See Appendix at the end of this document for pre-approved materials.
- B. All products shall be new and unused and shall be of manufacturer's current and standard production.
- C. Contractor shall confirm all equipment part numbers with the District prior to ordering equipment and updating submittals as required.
- D. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory operation.

## **2.2 PRODUCT AVAILABILITY**

- A. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.

## **2.3 CONDUIT AND RACEWAY**

- A. See division 27 05 00 for conduit and raceway requirements.

## **2.4 WIRE AND CABLE**

- A. Refer to Appendix A for Pre-approved manufacturers and part numbers.
- B. Provide all new wire and cable required to install systems as indicated on design documents.
- C. Fiber optic cables shall be tight buffered laser optimized, 6 strands for Elementary Schools and 12 strands for Middle and High school. Any cable shall not exceed a .30" diameter.
  - 1. Fiber optic cable shall have a minimum effective modal bandwidth of 3500 MHz/Km. See Appendix at the end of this document for approved material.
- D. Fiber Optic connectors for multi-mode shall be industry standard LC type connectors. See Appendix at the end of this document for approved material.

## **COMMUNICATION BACKBONE CABLING**

- E. MDF rack mount fiber optic enclosures (LIU) shall be as outlined in Appendix at the end of this document and completely loaded with Ceramic ferrule Duplex LC Packs unless listed otherwise in drawings and details or approved equal.
- F. Furnish one (1)-meter LC to LC duplex cross over fiber patch cord for every two terminations at IDF locations and one (2) meter LC to LC duplex cross over fiber patch cord for every two terminations at MDF location. The patch cords shall have connectors with ceramic ferrules. All patch cords shall be packaged with a factory performance certification report. Verify all lengths before ordering.

## **2.5 FIBER OPTIC CABLE MANAGEMENT RING**

- A. Re-closable ring cable management device. Ring should be 24 inches in diameter for Copper Multipair, OSP, or Armored cable, and 12" diameter for Indoor fiber cable.
- B. Ring to be mounted on the backboard at the OSP fiber entrance as indicated. Six hook and loop style loops attached.
- C. Approved Products
  - 1. Leviton 24" Velcro fiber spool, 48900-OFR
  - 2. Leviton 12" Velcro fiber spool, 48900-IFR

## **2.6 PATCH CORDS**

- A. See section 27 16 00 for requirements

## **2.7 LOW VOLTAGE ENCLOSURES AND PATHWAYS**

- A. See section 27 05 00 for additional requirements.

## **PART 3 EXECUTION**

### **3.1 ACCEPTABLE INSTALLERS**

- A. The cable plant system shall only be installed by Contractors who are qualified to install, service and maintain the cable plant system.
- B. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years' experience before the Bid Opening Date.

### **3.2 EXAMINATION**

## **COMMUNICATION BACKBONE CABLING**

- A. The Contractor shall be required to visit the installation site(s) prior to bidding the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to the District.
- B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

### **3.3 PREPARATION**

- A. The Contractor shall order all required parts and equipment upon receipt of approved product submittals.
- B. The Contractor shall verify the availability of power where required.

### **3.4 SHOP DRAWINGS**

- A. See section 27 00 00 for requirements
- B. Submit drawings for review and approval by Project Manager.

### **3.5 INSTALLATION**

- A. See 27 05 00 for additional routing requirements
- B. The cables will be routed to their respective Main Distribution Frame (MDF) or Intermediate Distribution Frame (IDF) utilizing the shortest path possible while maintaining right angles to the building structure.
- C. Contractor is required to adhere to the parameters in this section whether or not existing equipment has been placed by Contractor and/or others.
- D. Contractor will notify the District if any of the requirements cannot be met prior to bid.
- E. Voice copper backbone
  - 1. Terminations shall be T568B configuration unless otherwise specified.
  - 2. Labeling
    - a. Wiring termination locations shall be labeled to corresponding pairs at the MDF and IDF.

### **COMMUNICATION BACKBONE CABLING**



- b. Cables shall be labeled no more than 3" back from each end of the termination point with a cable label that matches the patch panel labeling.
- c. Contractor will provide tags, straps, and adhesive labels. These tags, straps, and adhesive labels shall be of high quality that will endure over time.
- d. Handwritten labels are not acceptable.
- e. Each pair shall have a unique label throughout the site. This would allow a cable management system to track each cable pair.
- f. Labeling Scheme
  - 1. Closet labeling: 66-block or surface-mount quickport box shall be labeled with the destination MDF or IDF #, sequential feeder pair number only. The labeling itself shall be in a white background with black lettering.

F. Data Fiber Backbone

- 1. The District has standardized on materials that provide component quality and maintainability. Refer to the Appendix A at the end of this specification for pre-approved material.
- 2. Fiber Optics Cable Installation and Testing.
  - a. Service loops shall be secured to backboard or rear of cabinet using a pre-manufactured fiber optic wheel with Velcro straps. If installed at rear of cabinet, the wheel shall be placed at a height that will not interfere with equipment to be installed in the cabinet.
  - b. Fiber cables shall be securely mounted to the fiber enclosure using zip ties in at least two locations around the jacket to prevent cable twisting and movement. In addition, the Kevlar or strength member shall be bolted, tied, or securely fastened to the enclosure.
  - c. Fibers strands shall be neatly organized in the enclosure with individual bundled paths from each cable to the bulkheads in which they are mounted.
  - d. Fiber strands shall be made to rest in their final position without tension or stress of any kind.

COMMUNICATION BACKBONE CABLING

- e. All spare optical ports and connectors shall have a dust cap in place to protect from the environment.
  - f. Contractor shall provide and install blanks in unused spaces of the fiber enclosure.
  - g. All unused optical ports on the LIU shall have protective covers that prevents dust and particles to enter the port.
3. Fiber Optics Labeling
- a. Fiber termination locations shall be labeled to corresponding fiber strands pairs at the MDF and IDF.
  - b. The labeling scheme shall be submitted by the contractor for District / District representative approval prior to installation.
  - c. Contractor is expected to provide tags, straps, and adhesive labels. These tags, straps, and adhesive labels shall be of high quality that will endure over time.
  - d. Handwritten labels are not acceptable.
  - e. Labeling requirements
    - 1. Cables shall be labeled approximately 12 inches back from the point where the cable enters the fiber enclosure with a cable label that identifies the origin and destination of the cable.
    - 2. Closet labeling; each connection shall be labeled denoting each strands number, origin and destination.
    - 3. The type (single-mode or multi-mode) of fiber optic cable used shall be clearly labeled on the fiber patch panel per drawn details.
    - 4. Color-coding shall conform to ANSI/TIA specifications.
4. Fiber Optics Testing
- a. All optical test equipment shall have current, traceable calibration certification.

- b. If fiber is supplied to Contractor by the district shall be tested before installation, while still on the shipping reel, using an optical time domain reflectometer (OTDR). The test results shall be compared to the manufacturers test results. A discrepancy of more than 1 dB on any fiber in either window indicates possible shipping damage and the fiber shall be returned to the supplier. The test results shall be maintained in a file for future reference.
- c. All fiber shall be tested after installation according to the Method A procedures described in ANST/TIA-568-C.
- d. Power meter test equipment shall produce a machine generated test report containing the minimum of the following test information:
  - 1. Contractor's Name
  - 2. Operator's Name
  - 3. Customer's location
  - 4. Closet Location
  - 5. Cable ID
  - 6. Test Summary – i.e. Pass/Fail
  - 7. Date and Time of test
  - 8. Test Standard
  - 9. Equipment serial numbers
  - 10. Length in Feet
  - 11. Test direction – i.e. MDF to IDF=A-B / IDF to MDF=B-A
  - 12. Wavelength
  - 13. Optical loss in dB
  - 14. Optical loss limit
  - 15. Reference setting
  - 16. Reference setting date and time

#### COMMUNICATION BACKBONE CABLING

(Most bi-directional test sets will meet these criteria providing the operator enters the proper information. Contractor shall notify the project manager before testing if there is any question regarding this requirement)

- e. In addition to power meter testing, OTDR testing is to be performed in any location where the fiber is not continuous, i.e. coupled LC connectors (soft splice), fusion splice, and mechanical splice. When testing with an OTDR the contractor shall utilize a test lead or launch cable a minimum of 100 meters in length and a trail test cable a minimum of 100 meters in length. The contractor shall set a marker at the start and end of the tested cable on each test result and the difference in loss between the two markers shall be noted on the test report. The results of these tests (printed OTDR result power meter attenuation results) shall be provided by the installer as documentation of the quality of installation and as a baseline for future troubleshooting. The results shall be compared to the pre-installation test results for significant changes.
- f. The multi-mode cable shall comply with maximum individual fiber loss limits in accordance with ANSI/TIA-568-C Multimode, OM4.
- g. Aerial fiber cable mounting hardware shall be matched to the all dielectric self-supporting (ADSS) fiber cable exactly and be installed in accordance with mounting hardware and cabling manufacturers specifications.

### **3.6 WORKMANSHIP**

- A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship. Contractors unfamiliar with the District's standards shall familiarize themselves with the District's standards and requirements prior to beginning work.
- B. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.
- C. Perform Work with persons experienced and qualified to produce workmanship specified.
- D. Maintain quality control over suppliers and Subcontractors.

COMMUNICATION BACKBONE CABLING

- E. Quality of workmanship is considered important. The District's Project Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.

### **3.7 CABLE**

- A. Design, layout, size, and plan new cable runs as required.
- B. All wire and cable passing thru metalwork shall be sleeved by an approved grommet or bushing.
- C. Conduit/raceway fill shall not exceed 40 percent of interior cross-sectional area.
- D. Identify all cables at terminations. Identification shall be made with an approved permanent label, machine generated 1/4" black letters on white tape (Brady or equal.)
- E. Underground cable shall be rated for use.
- F. Neatly dress and tie all cabling.

### **3.8 CONDUIT AND RACEWAY INSTALLATION**

- A. Design, lay-out, size and plan new conduit and raceway systems as required.
- B. Install conduit and raceway in accordance with Division 27 05 00 requirements.

### **3.9 PENETRATIONS, CUTTING AND PATCHING, DEMOLITION, PAINTING**

- A. See section 27 05 00 for requirements

### **3.10 FIELD QUALITY CONTROL AND TESTING**

- A. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify District of your readiness to perform the formal Test & Inspection of the complete system.
- B. Submit the Record Drawings (as-builts) to District for review prior to inspection.
- C. During the formal Test & Inspection (Commissioning) of the system, have personnel available with tools and equipment to inspect wiring, devices and system operation.
- D. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.

COMMUNICATION BACKBONE CABLING

27 13 00 - 12

- E. Notify District when ready to perform a re-inspection of the installation.

### **3.11 EQUIPMENT INSTALLATION CONFIGURATION AND TESTING**

- A. See section 27 21 00 for requirements

### **3.12 AS-BUILT DRAWINGS AND TEST RESULTS**

- A. See section 27 00 00 for requirements.

**APPENDIX-A**  
**(Unless Otherwise Specified on Construction Document Plan Sheets)**

**PATCH PANEL AND WIRE MANAGEMENT**

DESCRIPTION	MANUFACTURER	PART NUMBER
48-Port Snap-in Patch Panel, 2U Wire management bar included	Leviton	49255-D48
Horizontal Cable Management	Leviton	49253-LPM

**FIBER / COPPER MATERIAL**

DESCRIPTION	MANUFACTURER	PART NUMBER
Leviton 2000i SDX Series fiber housing  a) 19" rack mounted units  completely loaded with Zirconia Ceramic LC fiber adapter plates	Leviton	1U = 5R1UH-S03  2U = 5R2UH-S06  4U = 5R4UH-S12
Fiber Wall Mount Enclosure	Leviton	5WMNT-01C
Leviton SDF fiber adapter plate	Leviton	5F100-2QL
12-strand OM4 LOMM 50um tight buffered plenum indoor/outdoor rated fiber (no loose tube)	Berk-Tek	PDP012FB3010/F5-I/O-C4(AQU)
4-pair or larger copper feeders		See division 27 15 00

**END OF APPENDIX A**

**END OF SECTION**

COMMUNICATION BACKBONE CABLING

27 13 00 - 14

**SECTION 271500  
COMMUNICATIONS HORIZONTAL CABLING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This section defines equipment, materials, accessories, installation, configuration and testing requirements for a complete and operational Communications Horizontal Cabling system. The system shall provide reliable high-performance data communication from the Main Distribution Frame (MDF) / Equipment Room (ER), Intermediate Distribution Frame (IDF) / Telecommunication Room (TR) or equipment control points to area workstations and communications device locations.

**1.2 SCOPE**

- A. The work will include but not be limited to the following objectives:
1. For new construction – provide, coordinate, and install all required components and accessories as outlined in the design documents for a complete and operable system.
  2. For existing construction – provide, coordinate, and install all components and accessories as outlined in the design documents to modify the existing system while maintaining compliance and to seamlessly integrate the new components into the existing system.
  3. Labor and Materials: The Contractor shall provide and pay for all labor, materials, equipment, tools, utilities, construction equipment and machinery, transportation and other facilities and services necessary for the proper execution, operation and completion of the scope of work.
  4. The Contractor shall furnish and install all new conduit/raceway and wire as indicated on the project drawings and/or as required to provide a fully functional system to the District/Architect/Engineer.
  5. The Contractor shall install new Category 6A (Cat 6A) data cabling, station outlets at locations as indicated on drawings. Terminations will be ANSI/TIA standard T568B wiring configuration into RJ45 workstation data jacks.

COMMUNICATIONS HORIZONTAL  
CABLING

27 15 00 - 1



6. The Contractor shall set up a complete wire management system at each MDF / ER, IDF / TR, this includes wire management organizer(s). Contractor shall provide the following:
  - a. One (1) vertical wire manager for each equipment rack to be installed (height to match equipment rack overall units)
  - b. One (1) 1RU horizontal wire manager for each new Cat 6A patch panel
  - c. One (1) 1RU horizontal wire manager for each switch to be installed
7. The Contractor is required to adhere to current industry standards when distributing and terminating cables:
  - a. All Cat 6A cables shall be secured to the rear cable management bar that is included with each of the patch panels.
  - b. At the rear of the patch panel, 50% of the cables shall enter the patch panel area from the right side and 50% of the cables enter from the left side. Cables shall be bundled in groups no larger than 25 cables. All bundled cabling shall be similar type per cable separation guidelines.
8. Prior to installation, If the length of the cable run appears to be exceeding 275' from station outlet to patch panel, the Contractor shall review requirement with Engineer.
9. If applicable, existing systems shall remain operable until new systems are accepted and approved by the District/Architect/Engineer or its representative.
10. All Category 6A (Cat 6A) installations shall carry Limited Lifetime warranty (see Division 27 00 00 for requirements).

### **1.3 RELATED REQUIREMENTS**

- A. Division 01 00 00 specifications, General Requirements
- B. Division 26 specification sections, as applicable
- C. Division 27 specification sections, as applicable
- D. Division 28 specification sections, as applicable

COMMUNICATIONS HORIZONTAL  
CABLING

27 15 00 - 2

#### **1.4 CODES AND STANDARDS**

- A. See specification section 27 00 00 for requirements

#### **1.5 CONTRACTOR QUALIFICATIONS**

- A. See specification section 27 00 00 for requirements

### **PART 2 PRODUCTS**

#### **2.1 GENERAL**

- A. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.
- B. Contractor shall confirm all equipment part numbers with the District/Architect/Engineer prior to ordering equipment and updating submittals as required.
- C. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory installation and operation.
- D. Product Availability
  - 1. Prior to submitting a project bid, the contractor shall determine product availability, delivery time, and shall include such considerations into the base bid for the communications systems scope of work as defined in the construction documents.

#### **2.2 CONDUIT AND RACEWAY**

- A. See specification section 27 05 00 for additional information and requirements

#### **2.3 WIRE AND CABLE**

- A. Provide all new wire and cable required to install systems as indicated on construction documents.
- B. Category 6A cable shall meet or exceed IEEE 802.3 for Gigabit Ethernet.
- C. Category 6A underground cable shall be rated for the application intended.

COMMUNICATIONS HORIZONTAL  
CABLING

27 15 00 - 3

- D. Cable management system shall be installed to provide a complete management system.

## **2.4 PATCH CORDS**

- A. See specification section 27 16 00 for additional information and requirements

## **2.5 LOW VOLTAGE ENCLOSURES AND PATHWAYS**

- A. See specification section 27 05 00 for additional information and requirements

# **PART 3 EXECUTION**

## **3.1 INSTALLATION**

- A. The cables will be routed to their respective Main Distribution Frame (MDF) or Intermediate Distribution Frame (IDF), to Node Termination Point (NTP) utilizing the shortest path possible while maintaining right angles to the building structure.
- B. Data UTP:
  - 1. Data terminations shall be T568B configuration.
  - 2. Patch panels shall be installed in accordance with manufacturer's installation guidelines.
  - 3. Labeling
    - a. Handwritten labels are not acceptable.
    - b. Cables shall be labeled no more than 4" inches back from each end of the termination point with a cable label that matches the station outlet labeling.
    - c. Wiring termination locations shall be labeled to corresponding pairs at the MDF / ER, IDF / TR, and at each station outlet end.
    - d. Contractor will provide tags, straps, and adhesive labels. These tags, straps, and adhesive labels shall be of high quality that will endure over time.
  - 4. Labeling Scheme
    - a. Workstation labeling:

COMMUNICATIONS HORIZONTAL  
CABLING

27 15 00 - 4

1. The faceplate or surface block shall be labeled with the MDF / ER, or IDF / TR number (#), sequential station outlet number for the MDF / ER, or IDF / TR (ex. 1.1-09).
  2. The labeling itself shall be in a white background with black lettering.
- b. MDF / IDF labeling:
1. Patch panel shall be labeled with the sequential station outlet number to match station outlet labeling.
  2. The labeling itself shall be in a black background with white lettering.
- c. Data UTP Testing
1. All data UTP cable shall be tested after installation according to the procedures and acceptability criteria described in ANSI/TIA Standards for Category 6 or Category 6A cable and connecting hardware. Test at level IIIe compliance or higher.
  2. Data UTP cable shall meet or exceed requirements for 10Gbps for Cat6A.
  3. Test results will be submitted per Section 27 00 00.
- C. Manufacturer's specification for pulling stress and minimum bend radius shall not be exceeded on any Category cable.
- D. Station Cable (UTP) or (STP) runs shall not exceed 295' feet (90 meters) on the permanent link.

### **3.2 CABLE**

- A. Design, layout, size, and plan new cable runs as required.
- B. All wire and cable passing thru metalwork shall be sleeved by an approved grommet or bushing.
- C. Conduit/raceway fill shall not exceed 40 percent of interior cross-sectional area.

### **COMMUNICATIONS HORIZONTAL CABLING**

27 15 00 - 5

- D. Identify all cables at terminations. Identification shall be made with an approved permanent label, machine generated 1/4" black letters on white tape (Brady or equal.)
- E. Underground cable shall be rated for use.
- F. Neatly dress and secure / strap all cabling.

### **3.3 WARRANTY, TESTING, AND COMMISSIONING**

- A. Refer to Division 27 00 00 for requirements.

### **3.4 CONTRACTOR CLOSEOUT DOCUMENTS AND TEST RESULTS**

- A. Refer to Division 27 00 00 for requirements.

**END OF SECTION**

COMMUNICATIONS HORIZONTAL  
CABLING  
27 15 00 - 6

**SECTION 271600  
CONNECTING CORDS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. The Work of this Section shall consist of the labor, materials and equipment required for furnishing and installing telecommunications patch cables and equipment cords as part of a complete and functional telecommunications system.
- B. All items specified or included in this section shall be furnished and installed by Telecommunications Contractor, wired and connected by Telecommunications Contractor and tested by Telecommunications Contractor, unless noted otherwise. "Contractor" as used herein shall mean Telecommunications Contractor or Telecommunications Contractor's sub-contractor.

**1.2 SCOPE**

- A. The work will include but not be limited to the following objectives:
  - 1. For new construction – provide, coordinate, and install all required components and accessories as outlined in the design documents for a complete and operable system.
  - 2. For existing construction – provide, coordinate, and install all components and accessories as outlined in the design documents to modify the existing system while maintaining compliance and to seamlessly integrate the new components into the existing campus' system.
  - 3. Contractor shall furnish and install all patch and equipment cords for both copper and fiber.
  - 4. Contractor to provide and install one patch cord at the MDF / IDF for each data drop installed. Each data drop installed shall be patched into an active port on the MDF / IDF data switch.
  - 5. Contractor shall, as scope dictates, coordinate with other trades for floor boxes, box covers, straps, above ceiling boxes and covers and all other requirements to install a complete and operable system.
  - 6. Labor and Materials: The Contractor shall provide and pay for all labor, materials, equipment, tools, transportation, and other services necessary for the proper execution, operation and completion of the work.

**CONNECTING CORDS**

27 16 00 - 1

7. Coordinate cord length, color, Category rating, Quantity, and plenum/non-plenum requirements in advance of ordering and installation.
8. Some patch cords may require advance ordering for manufacturing lead time. Coordinate and place order at earliest opportunity. Manufacturing or procurement delays are the responsibility of the Contractor.
9. The Contractor shall install patch cords at the MDF / IDFs to meet highest industry standards. This includes a complete wire management system as well as minimal patch cord slack as dictated further in this section.
10. If applicable, existing systems shall remain operable until new systems are accepted and approved by the District or its representative.
11. Contractor shall review with project manager proposed patch cord layout.
12. Contractor shall install patch cords in the data switches as indicated on port assignment sheet. If a port assignment sheet has not been provided with the data switches the contractor shall notify the project manager at least 2 weeks prior to scheduled install date.
13. The contractor shall complete all required project closeout documentation in a timely fashion.

### **1.3 RELATED REQUIREMENTS**

- A. Division 01 00 00 – General Requirements
- B. Division 27 00 00 - Communication
- C. Division 27 05 00 – Common Work Results for Communication Systems
- D. Division 27 11 00 – Equipment Rooms and Enclosures

### **1.4 INDUSTRY GUIDELINES AND STANDARDS**

- A. ANSI/TIA-568-1.D: Commercial Building Telecommunications Cabling Standard.
- B. ANSI/TIA -568-C.2: Balanced Twisted-Pair Telecommunications Cabling and Components Standard.
- C. ANSI/TIA/EIA-569-D: Telecommunications Pathways and Spaces.
- D. ANSI/TIA -606-C: Administration Standard for Telecommunications Infrastructure.

CONNECTING CORDS

27 16 00 - 2

- E. ANSI/TIA -607-C: Generic Telecommunications Bonding and Grounding (Earthing) Requirements for Customer Premises.
- F. ANSI/TIA -758-B: Customer-Owned Outside Plant Telecommunications Infrastructure Standard.

## **1.5 QUALIFICATIONS**

- A. The contractor shall possess a California C7 or C10 license.
- B. The Contractor or Subcontractor shall be Leviton certified to provide and install cable plant with 5 years documented experience.
- C. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.

## **1.6 REFERENCES**

- A. See Division 27 00 00 for requirements.

## **1.7 SYSTEM REQUIREMENTS**

- A. Any new installations or existing system modifications shall seamlessly integrate into the site's existing data cable plan system.

## **1.8 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS**

- A. See section 27 00 00 for requirements.

## **1.9 SUBMITTALS**

- A. See section 27 00 00 for requirements.

## **1.10 WARRANTY**

- A. Refer to Division 01 Warranty section.
- B. See section 27 00 00 for additional requirements.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- A. See Appendix A at the end of this document for pre-approved materials.
- B. All products shall be new, unused and without blemishes and shall be of manufacturer's current and standard production.

CONNECTING CORDS

27 16 00 - 3



- C. Contractor shall confirm all equipment part numbers with the District prior to ordering equipment and updating submittals as required.
- D. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory installation and operation.
- E. Product Availability: Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.

## **2.2 COPPER PATCH AND EQUIPMENT CORDS**

### **A. GENERAL**

- 1. Patch cord plug shall be a Slimline connector with integrated snag-less plug design made of FCC compliant 94V-0 clear material without incorporating the use of a rubber molded over-boot.
- 2. Patch cords in Plenum areas shall be Plenum-rated.
- 3. Patch cords shall meet ANSI/TIA-1096-A requirements to include 50 micro inches of gold plating.
- 4. The non-plenum patch cord jacket shall meet or exceed UL 444 CM rating and be RoHS compliant.
- 5. The patch cords shall be available in standard 1, 2, 3, 5, 7 and 10 foot lengths. Custom lengths from 1' and above shall also be available.

### **B. Standard copper patch cords for CAT6A UTP and FTP cable systems shall exhibit the following characteristics:**

- 1. Independently tested and verified for CAT 6A component performance.
- 2. Constructed of shielded 26 AWG stranded conductor cable for maximum flexibility and outside diameter of .240", for use in shielded and unshielded systems.
- 3. Power over Ethernet (PoE and PoE+) compatible to 100W PoE
- 4. See Appendix A for pre-approved established system colors.

CONNECTING CORDS

27 16 00 - 4

- C. Standard-diameter copper patch cords for CAT6A UTP user locations shall exhibit the following characteristics:
1. 26-gauge, unshielded, twisted pair, stranded conductor construction with a standard 8-position modular plug on both ends.
  2. Maximum Outer Diameter of 0.24"
  3. Power over Ethernet (PoE and PoE+) compatible to 100W
  4. See Appendix A for pre-approved established system colors.
- D. High-flex copper patch cords for CAT6A UTP cable systems used inside Telecom Enclosures, Rooms and racks shall exhibit the following characteristics:
1. 28-gauge, unshielded, twisted pair, stranded conductor construction with a standard 8-position modular plug on both ends.
  2. Ultra-narrow diameter, highly flexible cord for less congestion in higher density applications
  3. Maximum Outer Diameter of 0.15", minimum bend radius 0.60"
  4. Power over Ethernet (PoE and PoE+) compatible to 60W in unbundled configurations.
  5. Support 1 Gigabit applications over 90-meter permanent links with up to 6 meters of cordage
  6. To be used at patch panel end of any CAT6 UTP permanent link.
  7. Provide and install only factory-assembled patch cords of the same or better Category rating of the permanent link cabling system, in quantities as described in Part 3 of this Specification.
  8. See Appendix A for pre-approved established system colors.

## **2.3 FIBER OPTIC PATCH CORDS**

- A. Fiber optic LC-LC patch cords, or jumpers, will make LC connections from the rack termination points to the equipment. The jumpers will meet the following requirements:
1. Factory-manufactured using Laser-Optimized Fiber. Field terminations on fiber jumpers are not acceptable.

CONNECTING CORDS

27 16 00 - 5

2. Shall utilize A-B polarity.
3. Shall be available in standard lengths of 1, 2, 3, 5 and 10 meters and custom-orderable up to any length of feet or meters
4. Provide factory assembled patch cords meeting or exceeding all criteria specified in the horizontal cabling standard
5. Verify lengths, quantities, and configuration with actual project requirements prior to ordering and delivery.

### **PART 3 EXECUTION**

#### **3.1 ACCEPTABLE INSTALLERS**

- A. The cable plant system shall only be installed by Contractors who are qualified to install, service and maintain the cable plant system.
- B. The Contractor (or subcontractor listed at time of bid) must have at least five (5) years experience before the Bid Opening Date.

#### **3.2 EXAMINATION**

- A. The Contractor shall be required to visit the installation site(s) prior to bidding the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to the District.
- B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

#### **3.3 PREPARATION**

- A. The Contractor shall order all required parts and equipment upon receipt of approved product submittals.

#### **3.4 INSTALLATION**

- A. Contractor to provide and install fiber and copper patch cords in quantities as described below. Neatly install patch cords in lengths as appropriate to keep reduce unnecessary length in wire managers. No more than 12" of slack for the copper patch cords will be allowed.

CONNECTING CORDS

27 16 00 - 6

- B. Install patch cords at the equipment cabinet between patch panel and equipment / switches for each patch panel and workstation location. Patch cords shall direct-connect between patch panel and networking switch or other electronics equipment. Dress and bundle patch cords as appropriate for final installation. Provide any unused equipment patch cables to District in original packaging upon completion of project.
- C. Provide workstation patch cords to District in original packaging.
- D. All fiber patch cords and required workstation/equipment patch cords not installed shall be provided in hand to Districts Representative prior to project closeout.
- E. Install all patch cords in accordance with the Districts I.T. Department or the person in charge of the telecommunications infrastructure.
- F. Bend radius of cables shall be maintained as recommended by the manufacturer and per BICSI standards.
- G. Dress and bundle all patch cords in a neat and workmanlike manner. Do not create patch cord bundles larger than 24 cables. Use Velcro every 12" or less and as needed at turn and entry points to secure and organize cords.
- H. Provide strain relief as needed using Velcro straps. Utilize cable managers for routing cords among devices.
- I. Use the following guidelines for project bid. Verify all lengths with project requirements / excess slack requirements prior to ordering / purchase:
  - 1. Provide one (1) 10-foot patch cord of the same category rating, at the workstation for each cable terminated at the terminal outlet location
  - 2. Provide one (1) 2-meter patch cord of the same grade of fiber, for each LC connector pair installed at the IDF, MDF, and all other terminal enclosure locations.

### **3.5 WORKMANSHIP**

- A. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform Work with persons experienced and qualified to produce workmanship specified.
- C. Maintain quality control over suppliers and Subcontractors.

CONNECTING CORDS

27 16 00 - 7

- D. Quality of workmanship is considered important. The District's Project Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.

**APPENDIX-A**  
**(Unless Otherwise Specified on Construction Document Plan Sheets)**

**CAT 6 / 6A PATCH CORDS / FIBER PATCH CORDS**

DESCRIPTION	MANUFACTURER	PART NUMBER
Cat 6 Patch cables, eXtreme High Flex HD6 (O.D. 0.15")  (Insert length in feet 6I [6"], 01', 02', 03', 05' 07', 10' instead of XX in part number)  Insert color instead of "*" in part number. <ul style="list-style-type: none"> <li>• Data (includes voice)/UPS – Blue (L)</li> <li>• IP Clock – Gray (S)</li> <li>• Admin – Red (R)</li> <li>• CCTV – Green (G)</li> <li>• Access Control – Green (G)</li> <li>• HVAC – Yellow (Y)</li> <li>• Lighting Control – Yellow (Y)</li> <li>• Audio-Visual - Orange</li> <li>• Switch uplink – Black (E)</li> </ul>	Leviton, or equal	6H460-XX*
Cat6 Patch Cables, slim  Intrusion Alarm – Pink	Leviton	Cat6 Unshielded (UTP) Slim Ethernet Network Patch Cable-Pink, length as required
Cat6A Patch Cables, slim  Wireless AP - Purple	Leviton	Cat6A Unshielded (UTP) Slim Ethernet Network Patch Cable-Purple, length as required
1M or 2M LC to LC OS2 / OM4 cross-over patch cords	Leviton	Length as needed

**END OF APPENDIX A**

**END OF SECTION**

CONNECTING CORDS

27 16 00 - 9

**SECTION 274100  
AUDIO-VISUAL SYSTEMS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Quality workmanship is a high priority for the District and the Contractor shall be held to a high-level of professional workmanship. Contractors unfamiliar with the District's standards shall familiarize themselves with the District's standards and requirements prior to beginning work.
- B. For new construction – provide and install all components and accessories as outlined in the design documents for a complete and operable system.
- C. Labor and Materials: The Contractor shall provide and pay for all labor, materials, equipment, tools, utilities, construction equipment and machinery, transportation and other facilities and services necessary for the proper execution, operation and completion of the Work.
- D. The Contractor shall furnish and install all new conduit/raceway and wire as indicated on the project drawings and/or as required to provide a turn-key system.
- E. The Contractor shall install wire and cable that is appropriate for the installed environment (i.e., non-plenum, plenum, underground & etc.)
- F. The Contractor shall be responsible for all programming, commissioning, and activation the Audio-Visual System.
- G. The Contractor shall review the proposed final system programming, functionality and expectations with the project manager, Architect/Engineer/Designer and District prior to final programming.
- H. After completion of the installation and pretest of the system a satisfactory final test of the entire system shall be performed by the contractor, in the presence of the District and project designer, to demonstrate system functionality and operation.
- I. Project Management
  - 1. The Supplier/Installation Contractor will provide the following Project Management:

AUDIO VISUAL SYSTEMS

27 41 00 - 1

- a. Attend meetings with the client's technical and contract representative, providing status reports and resolution of questions or issues outstanding.
  - b. Develop project schedule and oversight of the installation team.
  - c. Stage equipment and materials at supplier's shop.
  - d. Facilitate completion of final punch-list items.
  - e. Assure that the finished system meets the design criteria and functions per the developed concept.
  - f. Remote Control Programming
  - g. Contractor Qualification and Training
2. The Contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to audio-visual, data, voice and imaging network systems. The Contractor shall at a minimum possess the following qualifications:
- a. Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.
  - b. Personnel trained and certified in the design of the approved manufacturer's products.
  - c. Personnel trained and certified to install the approved manufacturer's products.
  - d. The Contractor shall show proof of current certification of the approved manufacturer's products.
  - e. Provide references of the type of installation provide in this specification.
  - f. Personnel trained in the installation of pathways and support for housing horizontal and backbone cabling.
  - g. Personnel knowledgeable in local, state, province and national codes, and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.

AUDIO VISUAL SYSTEMS

27 41 00 - 2



- h. Be in business a minimum of Three (5) years.
- i. Must have personnel fluent in the use of Computer Aided Design and possess and operate Autodesk AutoCAD or Autodesk Revit BIM software using .DWG, .RVT, or .DXF format for required contractor shop and record as-build documents.
- j. Must possess current liability insurance certificates.

## **1.2 QUALITY ASSURANCE**

### **A. Conformance:**

1. All work shall conform to the applicable requirements of this project. A C-7 licensed Contractor in the State of California shall perform all low voltage work.
2. The A/V contractor shall be a factory direct dealer for, or establish an equivalent relationship with, the major equipment specified herein, suitable to carry out warranty administration and post warranty repair, and provide documentation of same
3. The Contractor shall notify the District, prior to submission of bid, about any part of the design, which fails to comply with abovementioned requirements.
4. If after contract is awarded, minor changes and additions are required by the mentioned authorities, even though such work is not shown on drawings or covered in the specifications, they shall be included at Contractor's expense.
5. The A/V contractor shall have been actively engaged in the installation of projects similar in scope and size for a minimum period of 5 years.
6. The A/V contractor shall be an active certified professional and provide documentation, of one or more of the following associations:
  - a. International Communication Industries Association (ICIA)
  - b. National Systems Contractors Association (NSCA),
  - c. Audio-Visual and Integrated Experience Association (AVIXA, CTS/CTS-I)
  - d. National Association of Broadcasters (NAB)

AUDIO VISUAL SYSTEMS

27 41 00 - 3

- e. Building Industry Consulting Service International (BICSI)
- 7. Any subcontractors to the A/V contractor will be allowed provided they comprise no more than 20% of the on-site work force and are under the direct supervision of the Project Manager or Installation Supervisor.
- B. Coordination:
  - 1. The Contractor shall become familiar with the existing conditions at the job site if applicable, and with the drawings and specifications and plan the installation of the audiovisual work to conform to the existing conditions to provide the best possible assembly of the combined work of all trades.
  - 2. The Contractor shall work out in advance all "tight" conditions, involving all trades and if found necessary, supplementary drawings shall be prepared by this Contractor, for the Architect's approval, before work proceeds in these areas.
  - 3. No additional cost will be considered for work, which must be relocated due to conflicts with the work of other trades.

### **1.3 SUBMITTALS**

- A. Pre-construction material submittals
  - 1. Products Material Submittal:
    - a. See Division 27 00 00 for Contractor Product Submittal requirements
  - 2. Contractor Installation Shop drawings
    - a. See Division 27 00 00 for Contractor Shop Drawing Installation requirements.
  - 3. Post construction submittals
    - a. Provide as-build documentation in accordance with Section 3.
    - b. Submit District's manual binders of all equipment documentation.
    - c. Provide a laminated simple operational sheet for end-users of system.
    - d. See section 27 00 00 for requirements.

**AUDIO VISUAL SYSTEMS**

**27 41 00 - 4**

## **PART 2 PRODUCTS**

### **2.1 CONTRACTOR PROVIDED PRODUCTS**

- A. As indicated on drawings to provide fully functional, integrated, and operational Audio-Visual system.

### **2.2 CABLE**

- A. Contractor must provide all cables and connectors from the wall plate to the TVs, projectors, speakers, switchers, amplifiers, and all other associated equipment to provide a fully functional, integrated and operational AV system.
- B. Speaker cable shall be minimum 14 awg, 2 conductor cable.

### **2.3 ENCLOSURES AND PATHWAYS**

- A. The AV contractor shall install an equipment rack as required to house the equipment to be installed.
- B. Use mounting hardware and anchors recommended by the Engineer of any material that shall be mounted to the building or structure.
- C. The Contractor shall select the appropriate mounting bracket kits for existing and new construction installations.
  - 1. The Contractor will provide a cable conduit/pathway to accommodate the necessary connections as outlined in the drawings and details.

### **2.4 POWER**

- A. The Contractor shall provide and/or repair electrical circuit(s), performed by C-10 licensed electrician), outlet(s) and connections where necessary to install the audio-visual and/or theatrical lighting DMX system.

## **PART 3 EXECUTION**

### **3.1 CABLE ROUTING**

- A. Cable shall be routed in appropriate conduit by system type as outlined in design details. Contractor is to contact District representative when this requirement cannot be met.
- B. Cable shall not be exposed at any point in the main cable path. Contractor is to use appropriate pathway for the situation (i.e., inside wall, conduit, or non-metallic surface raceway).

AUDIO VISUAL SYSTEMS

27 41 00 - 5

- C. Cables shall be protected and sleeved with a conduit in locations where cables need to pass through walls, floors, or hard ceilings. Contractor shall install threaded IMC or rigid conduit with large fender washers, lock rings, and screw on protective bushings on both ends.
- D. The fire rating of the wall must be maintained during and after installation.
- E. See Section 27 00 00 for additional requirements.

### **3.2 CABLE INSTALLATION PARAMETERS**

- A. Cabling
  - 1. Cable shall be installed in a neat and orderly manner. Loose cable shall be bundled, and tie wrapped with Velcro Ties
  - 2. All cables shall be terminated per drawing details provided by manufacturer.
- B. Conduit and Raceway
  - 1. A maximum fill capacity of 40% will be deemed acceptable for conduits.
  - 2. Install or replace pull-string after installing cable in any EMT, IMC, Rigid, or PVC conduits.
- C. Cables shall be identified with a machine-printed tag identifying the system type, source or head end location, and destination location in all access points (i.e., junction boxes, ground boxes, MDF, IDF, etc.) and as they enter or exit and conduit pathway. Handwritten labels shall not be accepted.
- D. All cabling shall be installed with proper stress relief and tied down.
- E. Manufacturer's specification for pulling stress and minimum bend radius shall not be exceeded on any cable.
- F. See Section 27 00 00 for additional requirements.

### **3.3 SYSTEM IMPLEMENTATION**

- A. The installation contractor will fine tune and test the systems for optimal audio and visual performance.
- B. Audio Signal:
  - 1. Signal-to-Noise ratio (including crosstalk): 70 dB minimum.

AUDIO VISUAL SYSTEMS

27 41 00 - 6

2. Total Harmonic Distortion: 0.05% maximum from 20 Hz. To 18 kHz.
3. Frequency Response: +/- 0.5 dB, 20 Hz to 20 kHz.

C. Audio Reproduction:

1. Signal-to-Noise ratio (including crosstalk): 55 dB minimum.
2. Total Harmonic Distortion: 0.05% maximum from 20 Hz. To 18 kHz.
3. Frequency Response:
  - a. Speech reinforcement loudspeakers, 4" or 6" dia.: +/- 1 dB 100 Hz to 2.5 kHz rolling off at 6 dB/octave from 125 Hz to 80 Hz and at 2 dB/octave above 2.5 kHz as measured on axis of loudspeaker.
  - b. Speech reinforcement loudspeakers, 8" or 12" dia.: +/- 1.5 dB 125 Hz to 2.5 kHz rolling off at 6 dB/octave from 100 Hz to 63 Hz and at 2 dB/octave above 2.5 kHz as measured on axis of loudspeaker.
  - c. Program reproduction loudspeakers: +/- 2 dB, 63 Hz to 6kHz decreasing uniformly from a relative level of 0 dB at 6 Hz to a relative level -5 dB at 20 kHz as measured on axis of loudspeaker.
4. Speech Reinforcement Sound Output Capability: Provide program levels of at least 96 dB and speech reinforcement levels of at least 85 dB everywhere in the seating area without objectionable distortion, rattles or buzzes. Use several different samples of recorded music as test signals.
5. Test microphones at each input.
6. Set master output limiting at -3dB with 10:1 ratio.
7. Hum and Noise: Hum and noise shall be inaudible under normal conditions from anywhere in the seating area.

D. Video Signal:

1. Signal-to-noise ratio (peak to RMS) unweighted DC to 5.5 MHz: 55 dB minimum.
2. Crosstalk unweighted DC to 5.5 MHz: 45 dB minimum.
3. Line and Field tilt: 2% maximum.
4. Differential Gain: 3% maximum.

AUDIO VISUAL SYSTEMS

27 41 00 - 7

5. Differential Phase: 2 degrees maximum.
- E. Video Timing:
  1. System Timing: Sync coincidence within 50 nanoseconds.
  2. Color Timing: Within 2 degrees at 3.58 MHz
- F. Optical Performance:
  1. The light fall-off from the center of the projected image to the four corners as measured at the projected image plane, shall not exceed 50%.
    - a. The installation contractor will fine tune and test the systems for optimal performance.
    - b. An District representative will be present to confirm system operation and to sign off on the system being complete.
    - c. Provide a turnkey audio-visual system to include equipment and materials, submittals, testing, staff training and warranty.
    - d. Installation shall include, but is not limited to engineering, labor and hardware for display, audio, video, control systems and related equipment rack, equipment mounting, plates, panels, connectors, cables.

### **3.4 TESTING AND ACCEPTANCE**

- A. Upon completion of installation, and prior to final acceptance by the District, the A/V Contractor shall demonstrate to the satisfaction of the Consultant and the District, the full operational functionality of all systems, all inputs/output stations, and sub-systems installed.
- B. Qualitative performance tests may include, but not be limited to, audio residual hum, noise & distortion, video signal hum, noise, sync quality and color fidelity.
- C. Test equipment required for these tests shall be supplied by the contractor and coordinated in advance with the Consultant.
- D. This shall not preclude the consultant from utilizing his own test equipment to confirm measurement results.
- E. Punch list items must be resolved prior to final acceptance.

### **3.5 TRAINING**

AUDIO VISUAL SYSTEMS

27 41 00 - 8

- A. The Contractor shall create quick start guides customized to the specific system being installed at each location. Quick start guides shall be prepared in advance of all training sessions so they can be distributed and reviewed with staff at time of initial training. All quick start guides shall be laminated.
- B. The contractor shall make a video recording of all training sessions and export to digital medium (USB Drive) for District archive.
- C. The Contractor shall provide 16-24 hours maximum of training for all large performance venue (theater, broadcast, gymnasium, stadium) installations. The Contractor shall be present for the first two (2) performances at large performance venue installations. Training shall occur over 5-7 days.
- D. The Contractor shall provide 8-12 hours maximum of training for all classroom, office and conference room installations. Training shall occur over 1-2 days.

### **3.6 CLOSEOUT DOCUMENTATION AND DRAWINGS**

- A. See section 27 00 00 for requirements.
- B. Warranty certificates and documentation
  - 1. Workmanship Warranty - The Supplier/Installation Contractor will concur that the Audio-Visual System furnished to be free from defects in workmanship (i.e., cables, connections, and structures) failure for a period of Two (2) Years from the date of acceptance.
  - 2. Equipment Manufacturer Warranty - The Supplier/Installation Contractor shall aid District in utilizing the benefits of applicable Manufacturer's equipment warranties.
  - 3. The Supplier/Installation Contractor shall broker or process this equipment for repair or replacement (no additional charge) to the applicable manufacturer for the term established by the manufacturer on a depot basis only.

### **END OF SECTION**

AUDIO VISUAL SYSTEMS

27 41 00 - 9

**SECTION 275123**  
**INTERCOMMUNICATION PROGRAM SYSTEMS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This section specifies intercommunications equipment, accessories, materials, installation, configuration, and testing requirements for a complete and operable system. This system shall provide the ability to communicate bi-directionally with an individual room, announce to defined speaker zones and bell tones on a programmed schedule.

**1.2 SCOPE**

- A. The Contractor shall provide and install all components and accessories as outlined in the design documents for a complete and operable system.
- B. For existing construction, the Contractor shall provide and install all components and accessories as outlined in the design documents to modify the existing system while maintaining code compliance and to seamlessly integrate the new components into the existing intercommunications system.
- C. Prior to commencement of work, the Contractor shall be responsible for identifying any existing system errors or faults and bring these issues to the attention of the Project Manager.
- D. The Contractor shall provide and pay for all labor, materials, equipment, tools, utilities, construction equipment and machinery, transportation and other facilities and services necessary for the proper execution, operation and completion of the Work.
- E. The Contractor shall furnish and install all new conduit/raceway and wire as indicated on the project drawings and/or as required to provide a turn-key system.
- F. The Contractor shall install wire and cable that is appropriate for the installed environment (i.e. non-plenum, plenum, underground & etc.)
- G. The Contractor shall be responsible for programming the Intercommunications System.
- H. The Contractor shall coordinate with site staff for bell schedule programming requirements.

INTERCOMMUNICATION PROGRAM  
SYSTEMS

27 51 23 - 1



- I. The Contractor shall review the proposed final system programming, functionality and expectations with the project District, Construction Manager, Architect, and Designer prior to final programming.
- J. After completion of the installation and pretest of the system a satisfactory final test of the entire system shall be made in the presence of the District, Construction Manager, Inspector of Record (IOR), and Designer.
- K. The Contractor shall adjust any speaker levels to the appropriate level as determined in system testing.

### **1.3 CODES AND STANDARDS**

- A. See Division 27 00 00 for requirements.

### **1.4 INDUSTRY GUIDELINES AND STANDARDS**

- A. ANSI/TIA-568-1.D: Commercial Building Telecommunications Cabling Standard.
- B. ANSI/TIA -568-C.2: Balanced Twisted-Pair Telecommunications Cabling and Components Standard.
- C. ANSI/TIA -606-C: Administration Standard for Telecommunications Infrastructure.
- D. ANSI/TIA -607-C: Generic Telecommunications Bonding and Grounding (Earthing) Requirements for Customer Premises

### **1.5 QUALIFICATIONS**

- A. The Contractor shall hold a California C7 or C10 license.
- B. The Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.
- C. The Contractor shall have been actively engaged in the installation of projects similar in scope and size for a minimum period of 5 years.
- D. The Contractor shall be a factory direct dealer for, or establish an equivalent relationship with, the major equipment specified herein, suitable to carry out warranty administration and post warranty repair and provide documentation of same.

INTERCOMMUNICATION PROGRAM  
SYSTEMS

27 51 23 - 2

- E. The Contractor shall notify the District, prior to submission of bid, about any part of the design, which fails to comply with abovementioned requirements.
- F. If after contract is awarded, minor changes and additions are required by the mentioned authorities, even though such work is not shown on drawings or covered in the specifications, they shall be included at Contractor's expense.
- G. The Contractor shall be fully conversant and capable in the cabling of low voltage, technology applications such as, but not limited to audio-video, data, voice and imaging network systems.
- H. The Contractor shall at a minimum possess the following qualifications:
  - I. Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.
  - J. Must possess current liability insurance certificates.
  - K. The Contractor shall show proof of current certification of the approved manufacturer's products.
  - L. Personnel trained and certified in the design of the approved manufacturer's products.
  - M. Personnel trained and certified to install the approved manufacturer's products.
  - N. Personnel trained in the installation of pathways and support for backbone and horizontal cabling.
  - O. Personnel knowledgeable in local, state, province and national codes, and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.

#### **1.6 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS**

- A. See Division 27 00 00 for requirements.

#### **1.7 SUBMITTALS**

- A. See Division 27 00 00 for requirements.

#### **1.8 WARRANTY**

- A. See Division 27 00 00 for requirements.

INTERCOMMUNICATION PROGRAM  
SYSTEMS

27 51 23 - 3

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- A. The approved manufacturers for the project are:
  - 1. Control unit and related accessories: As noted on construction drawings.
  - 2. Speakers: Unless noted otherwise on construction drawings.
    - a. Wire, cable, and accessories:
- B. All products shall be new and unused and shall be of manufacturer's current and standard production.
- C. Drawings and Specifications indicate major system components, and may not show all expansion modules, connectors, or accessories that may be required to support the operation specified. The Contractor shall provide all components needed for complete and operable system.

### **2.2 PRODUCT AVAILABILITY**

- A. Contractor, prior to submitting a bid, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
- B. Certain products specified may only be available through factory authorized dealers and distributors. The Contractor shall verify his ability to procure the products specified prior to submitting a bid.

### **2.3 CABLING**

- A. Single speaker cables shall be 4-Conductor, 22AWG, solid, with one pair shielded.
- B. Multi-pair speaker cables shall be 24-pair 22AWG solid with an overall shield.
- C. Cross-connect wire shall be Telecom Industry standard 22AWG solid twisted pair blue/white in color.

## **PART 3 EXECUTION**

### **3.1 EQUIPMENT AND CABINET INSTALLATION**

- A. Install equipment and cabinets per design documents.

INTERCOMMUNICATION PROGRAM  
SYSTEMS

27 51 23 - 4

- B. Install equipment/cabinets per manufacturer's installation requirements
- C. Communication system equipment shall conform to a 6-foot separation requirement from the main power panel, transformers, switchgear and/or starter motors adjacent to the main Termination Cabinet (TC1), intermediate TCs and termination locations.
- D. Install 3/4"-inch fire rated A-C plywood, cut to fit, in back of rack or cabinet.
- E. MDF and IDF rooms speaker termination blocks can be installed directly on the plywood walls.
- F. Care shall be taken to layout termination blocks in an organized and professional looking manner.
- G. Install termination blocks in accordance with manufacturer's design and installation guidelines.
- H. Install cable distribution spool post ("mushroom") in abundant quantity so cross-connect wire is supported and routed carefully.

### **3.2 CABLE INSTALLATION PARAMETERS**

- A. See section 27 0 00 for requirements.

### **3.3 CABLE ROUTING**

- A. Single and multi-pair speaker cable shall be routed in compliance with section 27 00 00.

### **3.4 CABLE TERMINATION**

- A. Each speaker cable shall be terminated at one speaker using the red (+), black (-) pair with wire nut to the appropriate speaker transformer wires for the wattage indicated in the design documents. Green and white pair are designated for spare.
- B. Cut off jacket, shielding and drain wire.
- C. Wrap end of speaker cables with white PVC electrical tape to prevent shielding from grounding/shorting.
- D. Wrap machine produced label with speaker ID at 4" from jacket end.

INTERCOMMUNICATION PROGRAM  
SYSTEMS

27 51 23 - 5

- E. All labels to be machine generated black letters on white adhesive label stock that is appropriate for the environment (interior/exterior). Handwritten labels are not acceptable.
- F. Provide 12" service loop at speaker.
- G. At the main terminal cabinet terminate each individual speaker cable on termination blocks in the following top to bottom order: Red, black, white, green and drain.
- H. Feeder cables shall be terminated on termination blocks each end.
- I. Terminate drains at upstream termination block only.
- J. The Contractor shall connect the intercommunications system to the site telephone system.
- K. Feeder cables shall be terminated using ANSI/TIA color-coding.

### **3.5 PROGRAMMING**

- A. The Contractor shall coordinate with site staff for Bell schedule programming requirements.
- B. The Contractor shall review the proposed final system programming, functionality and expectations with the District, Construction Manager, Architect, Designer prior to final programming.
- C. The Administrative telephone phone set port shall be 0100
- D. The telephone paging port shall be 0101
- E. Room speakers, the first digit corresponds to letter equivalent (A=1, B=2 continuing). The following 3-digits shall correspond to the final posted room numbers. Example: building A, room 202 would be: 1202.
- F. Exterior speakers shall start at 0501 and be sequential.

### **3.6 TESTING AND FINAL ADJUSTMENTS**

- A. Contractor shall test each speaker, cable, termination block combination with an impedance meter and record impedance and wattage readings to verify wiring and setting of wattage before connecting to the system headend. This record shall be made available for review at final acceptance.

INTERCOMMUNICATION PROGRAM  
SYSTEMS

27 51 23 - 6

- B. After completion of the installation and pretest of the system a satisfactory final test of the entire system shall be made in the presence of the District, Construction Manager, Architect, and Designer.
- C. The Contractor shall adjust individual speaker tap to the appropriate dB level as identified in system acceptance testing.

### **3.7 TRAINING**

- A. From the Administrative Paging phone and user telephone handset.
- B. Call a single room speaker
- C. Make an "All Interior" announcement
- D. Make an "All Exterior" announcement
- E. Make an "All Call" announcement
- F. Make an "Emergency All Call" announcement
- G. From the "administrative user" computer:
- H. Set up short-cut in web browser software to controller address
- I. Create and modify paging zones.
- J. Create and modify bell schedules.
- K. Create and modify Holiday schedules.

### **END OF SECTION**

INTERCOMMUNICATION PROGRAM  
SYSTEMS

27 51 23 - 7

**SECTION 275126**  
**ASSISTIVE LISTENING SYSTEMS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This section specifies equipment, accessories, materials, installation, configuration and testing requirements for a complete and operable Assistive Listening System. The systems shall be installed in each public meeting area in accordance with ADA Accessibility Guidelines for Buildings and Facilities (ADAAG) section 4.1.3(19); section 4.30 and section 4.33.

**1.2 SCOPE**

- A. The Assistive Listening System shall be an FM (72Hz (short range) 216MHz (long range) wireless system.
- B. Each system shall be complete consisting of transmitter, receivers, earphones, microphone, etc. as required.
- C. Features:
  - 1. No seating restrictions, 0-500 ft. system range.
  - 2. Single channel receivers are pre-tuned, users control their own volume.
  - 3. Easily expanded, no limit to number of users.
  - 4. Excellent sound quality, inherently free from interference.
  - 5. Automatic Gain Control for stable listening level.
  - 6. High performance frequency synthesized, phase-locked-loop tuning.
  - 7. 8 channels available.
  - 8. Powered by a rechargeable battery for portable operation.
  - 9. Choice of balance or unbalanced inputs.
  - 10. Input attenuator and low frequency attenuator control switches.
  - 11. LED Power and Audio Level Indicators.
  - 12. RF frequency range that meets ADA conformance guidelines.

ASSISTIVE LISTENING SYSTEMS

27 51 26 - 1

### **1.3 RELATED REQUIREMENTS**

- A. Division 01 00 00 – General Requirements
- B. Division 27 00 00 – Common Work Results for Communication Systems
- C. Division 27 41 00 - Audio / Video Systems

### **1.4 CODES AND STANDARDS**

- A. The installed system shall conform to all American with Disabilities Act (ADA) requirements.
- B. The installed system shall conform to all California State Codes.
  - 1. 2022 California Building Code (CBC)
  - 2. 2022 California Electrical Code (CEC)

### **1.5 UNDERWRITERS LABORATORY (UL) LISTING**

- A. All equipment shall be UL listed for its intended purpose.
- B. Any modification that voids the equipment's UL listing is strictly prohibited (i.e. relocated or oversize knock-outs).
- C. Any modified new equipment that voids the UL listing shall be replaced by the Contactor (parts and labor) at their expense.

### **1.6 QUALIFICATIONS**

- A. The Contractor shall possess a California C7 license.
- B. The installing Contractor or Subcontractor shall be authorized to provide and install equipment with 5 years of documented experience.
- C. The installing company and its subcontractors shall have an office located within 50 miles of the project site.

### **1.7 REFERENCES**

- A. See Division 27 00 00

### **1.8 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS**

- A. See Division 27 00 00 for requirements.

ASSISTIVE LISTENING SYSTEMS

27 51 26 - 2



## **1.9 SUBMITTALS**

- A. See Division 27 00 00 for requirements.

## **1.10 WARRANTY**

- A. Refer to Division 00 Warranty section.
- B. After the satisfactory completion letter has been received, a continuous and fault free thirty (30) day "burn-in" period shall begin. Any fault shall reset the "burn-in" period to zero (0). Warranty shall commence at day 31 of a successful and continuous "burn-in" period.

## **PART 2 PRODUCTS**

### **2.1 EQUIPMENT AND MATERIAL GENERAL**

- A. Acceptable Manufacturers: Firms regularly engaged in manufacturer of Assistive Listening Systems and accessory equipment of type and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years. All materials shall comply with applicable standards of the Underwriter's Laboratories, Inc.
- B. All equipment shall be the standard cataloged products of a single manufacturer.

### **2.2 BASE TRANSMITTER (provide 1 for each permanent sound system)**

- A. Provide -216MHz base transmitter with rack mount kit. Locate adjacent to the sound system equipment and get power from the equipment. Install where specified in the sound equipment rack and connect to content source.
- B. Antenna: Antenna and cabling to be mounted in seating area for Base Transmitter.

### **2.3 RECEIVERS**

- A. Adjustable channel receivers. Number of receivers required shall be in compliance with ADA public facility guidelines at time of installation. Current ADA guidelines require total number of receivers to be no less than 4% of total fixed seating capacity.

### **2.4 EARPHONES**

ASSISTIVE LISTENING SYSTEMS

27 51 26 - 3

- A. Single earphones with cord for normal to moderate hearing loss. (Provide 1 for each receiver).

## **2.5 NECK LOOPS**

- A. Provide qty. as required for ADA compliance.

## **2.6 BATTERIES**

- A. Provide long life rechargeable batteries, "Energizer", "Duracell" or equal, for each device requiring batteries such as portable transmitters and receivers.

## **2.7 WALL PLAQUE**

- A. Provide sound reinforcement wall plaque per ADA requirements to indicate equipment available for the hearing impaired. Verify location with the architect prior to installation. Submit sample for approval. Use the "international symbol of access for hearing impaired."

## **2.8 PORTABLE SYSTEMS**

- A. If area or space has amplified sound system and no fixed seating an Assistive Listening system shall be required. Specify a 72Hz 2-person minimum, 16-person maximum portable system. All batteries shall be rechargeable type with associated charging case.

# **PART 3 EXECUTION**

## **3.1 INSTALLATION**

- A. The contractor shall supply all labor, equipment, wire, conduit, materials, etc., required a complete and usable assistive listening system.

## **3.2 TESTS AND ADJUSTMENTS**

- A. Under completion of the installation of all equipment, and when same is in full operating condition, the Contractor shall perform the initial post completion tests and adjustments as specified hereinafter. Except as otherwise specified, this Contractor shall provide all instruments, equipment, labor and materials necessary to complete the tests.

## **3.3 FINAL DOCUMENT SUBMITTALS**

- A. See section 27 00 00, for requirements.

## **END OF SECTION**

## **ASSISTIVE LISTENING SYSTEMS**

## **SECTION 275313 CLOCK SYSTEMS**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. This section specifies equipment, accessories, materials, installation, configuration, and testing requirements for a complete and operable clock system.

#### **1.2 SCOPE**

- A. The project has standardized on Sapling for the Clock system.
- B. The Contractor shall provide and install all components and accessories as outlined in the design documents for a complete and operable system.
- C. Existing construction, the Contractor shall provide and install all components and accessories as outlined in the design documents to modify the existing system while maintaining code compliance and seamlessly integrate the new components into the existing Clock system. Prior to beginning any work, the Contractor shall be responsible for identifying any existing system errors or faults and bring these issues to the attention of the Construction Manager.
- D. Labor and Materials: The Contractor shall provide and pay for all labor, materials, equipment, tools, utilities, construction equipment and machinery, transportation and other facilities and services necessary for the proper execution, operation, and completion of the Work
- E. Contractor shall furnish and install all new conduit, raceway and wire as indicated on the project drawings and/or as required to provide a complete and operable system.
- F. The Contractor shall be responsible for all and any programming requirements of the Clock system.
- G. Upon completion of the installation of the system, a confirming walk test shall be performed verifying that each clock installed is operating and is displaying the correct time (has corrected as required). The project inspector, and other project representative shall be present.

CLOCK SYSTEMS

27 53 13 - 1

- H. The contractor is responsible for removing decommissioned and/or removed equipment, pathways and repairing any disturbed surfaces to match original surface condition.

### **1.3 CODES AND STANDARDS**

- A. See Division 27 00 00 for requirements.

### **1.4 INDUSTRY GUIDELINES AND STANDARDS**

- A. ANSI/TIA-568-1.D: Commercial Building Telecommunications Cabling Standard.
- B. ANSI/TIA -606-C: Administration Standard for Telecommunications Infrastructure.
- C. ANSI/TIA -607-C: Generic Telecommunications Bonding and Grounding (Earthing) Requirements for Customer Premises

### **1.5 QUALIFICATIONS**

- A. The Contractor shall hold a California C7 or C10 license.
- B. The Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.
- C. The Contractor shall have been actively engaged in the installation of projects similar in scope and size for a minimum period of 5 years.
- D. The Contractor shall be a factory direct dealer for, or establish an equivalent relationship with, the major equipment specified herein, suitable to carry out warranty administration and post warranty repair and provide documentation of same.
- E. The Contractor shall notify the District, prior to submission of bid, about any part of the design, which fails to comply with abovementioned requirements.
- F. If after contract is awarded, minor changes and additions are required by the mentioned authorities, even though such work is not shown on drawings or covered in the specifications, they shall be included at Contractor's expense.
- G. The Contractor shall at a minimum possess the following qualifications:
  - 1. Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.

CLOCK SYSTEMS

27 53 13 - 2

2. Must possess current liability insurance certificates.
3. The Contractor shall show proof of current certification of the approved manufacturer's products.
4. Personnel trained and certified in the design of the approved manufacturer's products.
5. Personnel trained and certified to install the approved manufacturer's products.
6. Personnel trained in the installation of pathways and support for backbone and horizontal cabling.
7. Personnel knowledgeable in local, state, province and national codes, and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.

#### **1.6 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS**

- A. See Division 27 00 00 for requirements.

#### **1.7 SUBMITTALS**

- A. See Division 27 00 00 for requirements.

#### **1.8 WARRANTY**

- A. See Division 27 00 00 for requirements.

### **PART 2 PRODUCTS**

#### **2.1 GENERAL**

- A. The Contractor shall furnish and install all equipment, material, devices, cables, control devices, labor requirement and necessary tooling to provide proper operation of the Clock system.

#### **2.2 CLOCKS**

- A. Reference construction drawings for manufacturer and model.

#### **2.3 CABLING**

CLOCK SYSTEMS

27 53 13 - 3

- A. IP Clock cables shall be 4-pair Cat6 minimum.
- B. Analog Clock cables shall be jacketed 3-conductor, 14AWG, stranded.
- C. Contractor shall be responsible for installing the proper cable type (underground, riser, or plenum) required by the installation environment.

## **2.4 SERVICE INVENTORY**

- A. Projects with over 15 installed clocks provide 3 extra standard clocks.

## **PART 3 EXECUTION**

### **3.1 CABLE INSTALLATION PARAMETERS**

- A. See section 27 00 00 for requirements.
- B. For dedicated MDF/IDF rooms clock termination strips can be installed on the plywood walls without the need for a metal cabinet.
- C. Care shall be taken to layout termination field in an organized and professional looking manner.
- D. Cable:
  - 1. Clock cable to be terminated as follows: white = common, black = run power, red = correction.
  - 2. For transition interior to OSP cable terminate as follows: white -> blue, black -> black, red -> red with OSP brown as spare.
- E. Cables shall be labeled with destination description 4" back from jacket end. (i.e. "To TC1.1 Rm.12A").
- F. System Master Clock
  - 1. The Contractor shall configure the master clock system for time synchronization to the PST time server.
  - 2. The Contractor shall configure the master clock system for hourly clock correction at 59th minute of each hour.
  - 3. The Contractor shall configure the master clock system for full clock correction at 11:59 AM and 11:59 PM.

CLOCK SYSTEMS

27 53 13 - 4

4. The Contractor shall verify that all clocks correct at correction times.

**END OF SECTION**

## **SECTION 281000 ACCESS CONTROL**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. This section specifies equipment, accessories, materials, installation, configuration, and testing requirements for a complete and operable Access Control system. The system shall provide electronic access control to doors that require the means to either be remotely opened or grant access for credentialed personnel.

#### **1.2 SCOPE**

- A. The work will include but not be limited to the following objectives:
1. The District has standardized on Lenel S2 Security for projects that require electronic access with proximity cards/fobs.
  2. Labor and Materials: The Contractor shall provide and pay for all labor, materials, equipment, tools, utilities, construction equipment and machinery, transportation and other facilities and services necessary for the proper execution, operation, and completion of the Work.
  3. The Contractor shall provide and coordinate installation of door hardware with Division 08.
  4. The Contractor shall furnish and install all new conduit/raceway and wire as indicated on the project drawings and/or as required to provide a turn-key system to the District.
  5. After completion of the installation and pretest of the system a satisfactory final test of the entire system shall be made in the presence of the District or the District's representative.
  6. Existing systems shall remain operable until new systems are accepted and approved by the District or its representative.
  7. The contractor is responsible for user/operator training.
  8. The contractor shall complete all required project closeout documentation in a timely fashion.
  9. All exterior doors shall have electronic card access unless otherwise noted.
  10. Any new installations or existing system modifications shall seamlessly integrate into the site's existing Access Control system.
- B. It is the responsibility of the access control integrator or company to generate an exceptions list prior to bidding or installation that itemizes

ACCESS CONTROL

28 10 00 - 1



exceptions taken with door hardware schedules, components or designs being used which may hamper their ability to provide a secure and compliant access control product.

### **1.3 RELATED REQUIREMENTS**

- A. Division 26 sections, as applicable
- B. Division 27 sections, as applicable
- C. Division 28 sections, as applicable

### **1.4 CODES AND STANDARDS**

- A. The contractor shall possess a California a C7 or C10 license.
- B. The Contractor or Subcontractor shall be factory authorized to provide and install equipment with 5 years documented experience.
- C. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.

### **1.5 REFERENCES**

- A. See Division 27 00 00 for additional information/requirements.

### **1.6 CONTRACTOR “SHOP DRAWINGS” DESIGN REQUIREMENTS**

- A. See Division 27 00 00 for requirements.

### **1.7 SUBMITTALS**

- A. See Division 27 00 00 for requirements.

### **1.8 WARRANTY**

- A. See Division 27 00 00 additional for requirements.

ACCESS CONTROL  
28 10 00 - 2

- B. After the satisfactory completion letter has been received, a continuous and fault free thirty (30) day "burn-in" period shall begin. Any fault shall reset the "burn-in" period to zero (0). Warranty shall commence at day 31 of a successful and continuous "burn-in" period.

## **PART 2 PRODUCTS**

### **1.9 GENERAL**

- A. Door hardware to be coordinated with Division 08.
- B. All products shall be new and unused and shall be of manufacturer's current and standard production.
- C. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory operation.
- D. Product Availability
  - 1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
  - 2. Certain products specified may only be available through factory authorized dealers and distributors. Contractor shall verify his ability to procure the products specified prior to submitting a proposal.

### **1.10 CONDUIT AND RACEWAY**

- A. See Division 27 05 00 for conduit and raceway requirements.

### **1.11 WIRE AND CABLE**

- A. Provide all new wire and cable required to install systems as indicated on design documents.
- B. All cables shall be specifically designed for their intended use (plenum, direct burial, aerial, and etc.).
- C. Wire and cable shall be sized to provide minimum voltage drop and minimum resistance to the devices being supplied.

ACCESS CONTROL

28 10 00 - 3

- D. Comply with design documents and equipment manufacturers recommendations for wire and cable size and type.
- E. Comply with all applicable codes and ordinances.
- F. No splicing of wire is allowed.
- G. All wire junctions are to be at devices and/or terminal strips.
- H. Color of conductors shall be consistent throughout the system.

## **PART 3 EXECUTION**

### **1.12 ACCEPTABLE INSTALLERS**

- A. The system shall only be provided by Contractors who are factory authorized to install, service and maintain the system.

### **1.13 EXAMINATION**

- A. The Contractor shall be required to visit the installation site(s) prior to bidding the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to the District.
- B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

### **1.14 INSTALLATION**

- A. Panel and any network device server will be wired through a dedicated power supply with battery backup.
- B. Power is to be access control panels is to be hardwired utilizing EMT or rigid conduit in accordance with Wiring and Conduit section of this specification.  
Access control panels are to be installed in network (MDF or IDF) or electrical closets as approved by District / District's representative. All panels and boards must be installed in Life Safety Power enclosure(s)

ACCESS CONTROL

28 10 00 - 4

(within the designated location) that are of sufficient size and orientation to include all card access system components. All enclosures must be lockable and located in a manner that the enclosures will be accessible by maintenance personnel.

- C. Each panel will be labeled in accordance with District standards. The label for each panel will be posted on the exterior of the panel door.
- D. Each panel will have a list of readers (door locations) connected to it located on the inside cover. A detailed door and reader layout drawing will be located on the inside of the panel door in an appropriate sleeve and keeper.
- E. Installation of network connection drop is to be coordinated through District / District's representative. Drop termination is to be inside of access control panel to prevent tampering. The MAC address and IP address for each panel/device will be posted on the inside panel door. All panel boxes are to have functioning locking hardware with keys. Keys will be submitted to the Electronics Shop upon completion of install.
- F. All low voltage cables shall be kept away from power circuits.
- G. All panels and power supplies shall be labeled with 3/8 inch printed black lettering on white labels indicating AC electrical power panel, circuit breaker number and panel location.
- H. Labeling material shall be heavy duty and appropriate for the environment in which it is installed.

#### **1.15 WORKMANSHIP**

- A. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform Work with persons experienced and qualified to produce workmanship specified.
- C. Maintain quality control over suppliers and Subcontractors.
- D. Quality of workmanship is considered important. The District / Architect, and Engineer Project Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.

ACCESS CONTROL

28 10 00 - 5

#### **1.16 CABLE AND CONDUCTORS**

- A. Design, layout, size, and plan new cable runs as required.
- B. All cables shall be installed in accordance with Division 27 15 00 and code requirements.
- C. All wire and cable passing thru metalwork shall be sleeved by an approved grommet or bushing.
- D. Conduit/raceway fill shall not exceed 40 percent of interior cross-sectional area.
- E. Identify all cables at terminations and at every junction box. Identification shall be made with an approved permanent label, machine generated 1/4" black letters on white tape (Brady or equal.)
- F. Neatly dress and tie all cabling.

#### **1.17 CONDUIT AND RACEWAY INSTALLATION, PENETRATIONS, CUTTING AND PATCHING, DEMOLITION, PAINTING**

- A. Do not penetrate any roof, flashing, exterior wall, or parapet without prior approval from District's designated Construction Project representative.
- B. When penetrating a fire wall for passage of cables and/or conduit, always provide a UL listed fire-stop system that complies with code and the local authority having jurisdiction.
- C. Where conduit penetrates exterior walls, seal opening around conduit in an approved manner to make watertight.
- D. Refer to section 27 05 00 for additional requirements.

#### **1.18 FIELD QUALITY CONTROL AND TESTING**

- A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- B. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify District of your readiness to perform the formal Test & Inspection of

ACCESS CONTROL

28 10 00 - 6

the complete system.

- C. Submit the Record Drawings (as-builts) to District for review prior to inspection.
- D. During the formal Test & Inspection (Commissioning) of the system, have personnel available with tools and equipment to inspect wiring, devices, and system operation.
- E. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

#### **END OF SECTION**

## **SECTION 282000 VIDEO SURVEILLANCE**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. This section specifies equipment, licenses, accessories, materials, installation, configuration, and testing requirements for a complete and operable video surveillance system.

#### **1.2 SCOPE**

- A. Furnish and install a surveillance camera system in accordance with the design drawings and specifications.
- B. Install conduit and raceways for video surveillance system.
- C. Install and configure network video recorder (NVR).
- D. Install and configure video management software.
- E. Install and configure surveillance cameras at exterior and interior locations.
- F. Camera power shall be provided from network PoE switch unless noted otherwise on design drawings.
- G. Cable lengths greater than 315', but less than 1000' long-range data extenders are permitted.
- H. Configure administrative video management software workstations for video monitoring and playback.
- I. Training for site personnel on how to operate the system primary and advanced functions as required.
- J. Calibration of the video surveillance system, as required. This includes but not be limited to the following: camera mounting and/or view adjustments, frame rates, video masking, and additional product feature settings as required.

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

- A. See Division 27 00 00 for requirements.

#### **1.4 INDUSTRY GUIDELINES AND STANDARDS**

VIDEO SURVEILLANCE

28 20 00 - 1

- A. ANSI/TIA-568-1.D: Commercial Building Telecommunications Cabling Standard.
- B. ANSI/TIA -568-C.2: Balanced Twisted-Pair Telecommunications Cabling and Components Standard.
- C. ANSI/TIA -606-C: Administration Standard for Telecommunications Infrastructure.
- D. ANSI/TIA -607-C: Generic Telecommunications Bonding and Grounding (Earthing) Requirements for Customer Premises.

## **1.5 QUALIFICATIONS**

- A. The Contractor shall hold a California C7 or C10 license.
- B. The Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.
- C. The Contractor shall have been actively engaged in the installation of projects similar in scope and size for a minimum period of 5 years.
- D. The Contractor shall be a factory direct dealer for, or establish an equivalent relationship with, the major equipment specified herein, suitable to carry out warranty administration and post warranty repair and provide documentation of same.
- E. The Contractor shall notify the District, prior to submission of bid, about any part of the design, which fails to comply with abovementioned requirements.
- F. If after contract is awarded, minor changes and additions are required by the mentioned authorities, even though such work is not shown on drawings or covered in the specifications, they shall be included at Contractor's expense.
- G. The Contractor shall be fully conversant and capable in the cabling of low voltage, technology applications such as, but not limited to audio-video, data, voice and imaging network systems.
- H. The Contractor shall at a minimum possess the following qualifications:
  - I. Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.
  - J. Must possess current liability insurance certificates.

VIDEO SURVEILLANCE

28 20 00 - 2



- K. The Contractor shall show proof of current certification of the approved manufacturer's products.
- L. Personnel trained and certified in the design of the approved manufacturer's products.
- M. Personnel trained and certified to install the approved manufacturer's products.
- N. Personnel trained in the installation of pathways and support for backbone and horizontal cabling.
- O. Personnel knowledgeable in local, state, province and national codes, and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.

#### **1.6 CONTRACTOR "SHOP DRAWINGS" DESIGN REQUIREMENTS**

- A. See Division 27 00 00 for requirements.

#### **1.7 SUBMITTALS**

- A. See Division 27 00 00 for requirements.

#### **1.8 WARRANTY**

- A. See Division 27 00 00 for requirements.

### **PART 2 PRODUCTS**

#### **2.1 GENERAL**

- A. All products shall be new and unused and shall be of manufacturer's current and standard production.
- B. Where two or more equipment items of the same kind are provided, all shall be identical and provided by the same manufacturer.
- C. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory operation.
- D. Product Availability

VIDEO SURVEILLANCE

28 20 00 - 3

1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
2. Certain products specified may only be available through factory authorized dealers and distributors. Contractor shall verify his ability to procure the products specified prior to submitting a proposal.

## **2.2 MATERIALS**

- A. See 27 15 00 Communications Horizontal Cabling for requirements
- B. Cameras, network video recorders (NVR), housings and mounts, network switches, LED display/monitor, including all materials and equipment necessary to provide a complete and operable system shall be as shown on design drawings.
- C. Surveillance Camera equipment shall be as specified on the design drawings.
- D. All exterior weatherproof cameras shall be installed with smoke dome covers.
- E. Cameras shall have one (1) each 64Gb microSDXC card properly formatted and installed.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. The Contractor shall be required to visit the installation site(s) prior to bidding the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to the District.
- B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

### **3.2 PREPARATION**

- A. The Contractor shall order all required parts and equipment upon receipt of approved product submittals.
- B. The Contractor shall bench test all equipment prior to delivery to the job site.

VIDEO SURVEILLANCE

28 20 00 - 4

- C. The Contractor shall verify the availability of power where required.
- D. The Contractor shall verify network PoE switch port availability and provide a new PoE switch when required.
- E. The Contractor shall verify network patch panel port availability and provide a new patch panel when required.

### **3.3 CABLE ROUTING**

- A. Refer to Division 27 15 00 Communications Horizontal Cabling for cable routing requirements.

### **3.4 EQUIPMENT MOUNTING PARAMETERS**

- A. All camera, monitors, recording equipment, racks and cabinets shall be anchored in accordance with manufacture specifications and drawn details, to walls and floors and grounded to building ground grid (not to water pipes etc.). Individual or new ground points are acceptable.

### **3.5 SYSTEM COMMISSIONING AND CALIBRATION**

- A. Contractor shall provide necessary time for commissioning and calibrating the entire video surveillance system.
- B. Camera views and adjustments:
  - 1. During training the district will shall gather information regarding final camera views and the areas the end user is trying to monitor.
  - 2. The contractor shall adjust cameras after reviewing the collected information with a site designated person. The contractor shall maintain contact with this site designated person via 2-way radio or telephone during final camera adjustments.
- C. The contractor, as part of contract documents, shall be responsible to return to the project site up to 60 days after activation to adjust and fine-tune cameras base on site and district staff direction. This 2nd adjustment shall be coordinated by the district authorized project manager or district staff.
- D. Head end adjustments, as required:
- E. Head end adjustments, including but not limited to frame rates, shall be made by the Contractor.

VIDEO SURVEILLANCE

28 20 00 - 5

- F. After camera views have been finalized the Contractor shall set up masking of non-essential video for each camera.

## APPENDIX-A

### (UNLESS OTHERWISE SPECIFIED ON CONSTRUCTION DOCUMENT PLAN SHEETS)

#### VIDEO SURVEILLANCE:

DESCRIPTION	MANUFACTURER	PART NUMBER
Network Video Recorder 48TB	exacqVision	IP0848T2Z2E
Camera license for each, enterprise version	exacqVision	EVENIP01
Camera license, upgrade Pro to Enterprise	exacqVision	EVIP-EVENIP
'Upgrade, 16GB RAM, XEPN E31276	exacqVision	EXQ500040383
'26" RKMT Sliding Rail Kit F/Z Series	exacqVision	EXQ500020070
Network Camera, exterior	AXIS	P3245-LVE
Network Camera, dome, interior	AXIS	P3245-V
Pole Mount	AXIS	T91B47
Adapters for protected cable routing in 3/4" conduit (M25 pipe).	AXIS	TP3601
White metal stand with hole for easy cable management. For indoor wall- or hard ceiling mount	AXIS	T91B21
Aluminum corner mount for indoor and outdoor use	AXIS	T94P01B
IP66/IP67 rated outdoor back box with conduit entrance	AXIS	T94S01P
Adapters for protected cable routing in 1/2" conduit (M20 pipe).	AXIS	TP3602
Pendant Wall Mount	AXIS	TP3101
J-Box & Pole Adapter	AXIS	TP3701
Outdoor recessed mount for roof overhang/soffit installations	AXIS	T94M02L
Outdoor pendant kit for mounting the camera on 1.5" NPS threaded brackets.	AXIS	T94T01D
Pole mount for fixed dome cameras	AXIS	T91B67
Smoked dome with anti-scratch hard coating, indoor	AXIS	TP3802
Smoked dome with anti-scratch hard coating, exterior	AXIS	TP3802-E
High endurance microSDXC™ card	AXIS	64GB
Audio and I/O Interface	AXIS	T6112

#### END OF SECTION

VIDEO SURVEILLANCE

28 20 00 - 7

**SECTION 283100  
INTRUSION DETECTION**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This section specifies equipment, accessories, materials, installation, configuration and testing requirements for a complete and operable Intrusion Detection system. The system shall provide intrusion alarm notification, monitoring, command and control and be connected to the District's monitoring station.

**1.2 SCOPE**

- A. For new construction – provide and install all components and accessories as outlined in the design documents for a complete and operable system.
- B. For existing construction - provide and install all components and accessories as outlined in the design documents to modify the existing system while maintaining code compliance and to seamlessly integrate the new components into the existing campus' system.
- C. Labor and Materials: The Contractor shall provide and pay for all labor, materials, equipment, tools, utilities, construction equipment and machinery, transportation and other facilities and services necessary for the proper execution, operation and completion of the Work.
- D. The Contractor shall furnish and install all new conduit/raceway and wire as indicated on the project drawings and/or as required to provide a turn-key system to the District.
- E. Exterior doors (entrance and roll-up) and roof access hatches are to be monitored by the Intrusion Detection system.
- F. Preferred mounting location for motion detectors is to be wall mounted 9' AFF with no casework below.
- G. The Contractor shall be responsible for programing the Intrusion Detection System.
- H. With one-week advance notice the Contractor shall coordinate with the District M&O staff for monitoring connectivity network addressing information.

INTRUSION DETECTION

28 31 00 - 1

- I. The contractor shall review the proposed final system programming, functionality and expectations with the project manager, Architect, Engineer and District prior to final programming.
- J. After completion of the installation and pretest of the system a satisfactory final test of the entire system shall be made in the presence of the inspector of record (IOR) and District or the District's representative.
- K. Existing systems shall remain operable until new systems are accepted and approved by the District or its representative.
- L. The contractor is responsible for District/user/operator training.
- M. The contractor shall complete all required project closeout documentation in a timely fashion.

### **1.3 RELATED REQUIREMENTS**

- A. Division 01 00 00 - General Requirements
- B. Division 26 05 00 – Common Work Results for Electrical
- C. Division 27 00 00 - Communications
- D. Division 27 05 00 – Common Work Results for Communications Systems
- E. Division 28 46 00 – Fire Detection and Alarm.

### **1.4 CODES AND STANDARDS**

- A. The installed system shall confirm to all California State Codes.
- B. 2022 California Building Code (CBC)
- C. 2022 California Electrical Code (CEC)
- D. 2022 California Fire Code (CFC)
- E. All equipment connected to the Fire Alarm system shall have California State Fire Marshall listing(s).

### **1.5 NATIONAL CODES:**

- A. 2022 NFPA 70 – National Electrical Code
- B. 2022 NFPA 72 – National Fire Alarm Code

INTRUSION DETECTION

28 31 00 - 2

- C. 2022 NFPA 101 – Life Safety Code
- D. Americans with Disabilities Act (ADA)
- E. Local building codes
- F. All requirements by the authority having jurisdiction (AHJ)

#### **1.6 UNDERWRITERS LABORATORY (UL) LISTING**

- A. All equipment shall be UL listed for its intended purpose.
- B. Any modification that voids the equipment’s UL listing is strictly prohibited (i.e. relocated or oversize knock-outs).
- C. Any modified new equipment that voids the UL listing shall be replaced by the Contactor (parts and labor) at their expense.

#### **1.7 QUALIFICATIONS**

- A. The contractor shall possess a California C10 license.
- B. The Contractor or Subcontractor shall be factory authorized to provide and install equipment with 5 years documented experience.
- C. Contractor shall be located within 50 miles or less from the project site to support 2-hour response time.

#### **1.8 REFERENCES**

- A. See Division 27 00 00

#### **1.9 SYSTEM REQUIREMENTS**

- A. Site compatibility:
  - 1. Any new installations or existing system modifications shall seamlessly integrate into the site’s existing Intrusion Detection system.

#### **1.10 CONTRACTOR “SHOP DRAWINGS” DESIGN REQUIREMENTS**

- A. See Division 27 00 00 for requirements.

#### **1.11 SUBMITTALS**

- A. See Division 27 00 00 for requirements.



- B. Provide copies of certificates listed in section 1.07 Qualifications (above).

#### **1.12 WARRANTY**

- A. Refer to Division 01 Warranty section.
- B. Refer to Division 27 00 00 for additional requirements.
- C. After the satisfactory completion letter has been received, a continuous and fault free thirty (30) day "burn-in" period shall begin. Any fault shall reset the "burn-in" period to zero (0). Warranty shall commence at day 31 of a successful and continuous "burn-in" period.

### **PART 2 PRODUCTS**

#### **2.1 GENERAL**

- A. All products shall be new and unused and shall be of manufacturer's current and standard production.
- B. Where two or more equipment items of the same kind are provided, all shall be identical and provided by the same manufacturer
- C. Drawings and Specifications indicate major system components, and may not show every component, connector, module, or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory operation.
- D. Product Availability
  - 1. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Contract Time.
  - 2. Certain products specified may only be available through factory authorized dealers and distributors. Contractor shall verify his ability to procure the products specified prior to submitting a proposal.

#### **2.2 CONDUIT AND RACEWAY**

- A. See Division 27 05 00 for conduit and raceway requirements.

#### **2.3 WIRE AND CABLE**

- A. Provide all new wire and cable required to install systems as indicated on design documents.

INTRUSION DETECTION

28 31 00 - 4

- B. Approved wire and cable manufacturer is West Penn, substitutions requires prior approval.
- C. Cable jacket color shall be white (OSP cable excluded)
- D. All cables shall be specifically designed for their intended use (plenum, direct burial, aerial, and etc.).
- E. Wire and cable shall be sized to provide minimum voltage drop and minimum resistance to the devices being supplied.
- F. Comply with design documents and equipment manufacturers recommendations for wire and cable size and type.
- G. Comply with all applicable codes and ordinances.
- H. No splicing of wire is allowed.
- I. All wire junctions are to be at devices and/or terminal strips.
- J. Color of conductors shall be consistent throughout the system.

## **2.4 BATTERIES**

- A. Approved manufacturer is PowerSonic or approved equal.
- B. Shall be 12-volt, sealed lead acid type
- C. Shall be sized per design documents or approved shop drawings.
- D. For extended run-time 2 batteries shall be provided.

## **2.5 EXTRA STOCK**

- A. For projects with less than 5 new Intrusion alarm devices – no extra stock required.
- B. For projects with 6 or more intrusion devices - provide extra stock of 2 (ea.) motion detector (current model) and 1 (ea.) monitor module (current model) per 100 project devices.

## **PART 3 EXECUTION**

### **3.1 ACCEPTABLE INSTALLERS**

- A. The system shall only be provided by Contractors who are factory authorized to install, service and maintain the system.

INTRUSION DETECTION

28 31 00 - 5

- B. The Contractor (or subcontractor listed at time of bid) must have been a factory authorized with the proposed manufacturer for a period of at least five (5) years before the Bid Opening Date.
- C. The Contractor's installers and technicians must also be factory trained and certified to perform such tasks.

### **3.2 EXAMINATION**

- A. The Contractor shall be required to visit the installation site(s) prior to bidding the job. The Contractor acknowledges that the failure to visit the site(s) will not relieve the Contractor of the responsibility for observing and considering those conditions which a Contractor would have observed and considered during a site visit, estimating properly the difficulty and cost of successfully performing the Work or proceeding to perform the Work without additional cost to the District.
- B. The Contractor shall report any discrepancies between the Specifications, Drawings, and Site Examination prior to the Bid Opening Date.

### **3.3 PREPARATION**

- A. The Contractor shall order all required parts and equipment upon receipt of approved product submittals.
- B. The Contractor shall bench test all equipment prior to delivery to the job site.
- C. The Contractor shall verify the availability of power where required.
- D. The Contractor shall arrange for obtaining all programming information required including network addressing information and existing site device numbering scheme.

### **3.4 SHOP DRAWINGS**

- A. See Division 27 00 00 for requirements
- B. Submit drawings for review and approval by Project Manager.

### **3.5 INSTALLATION**

- A. Utilize information gathered from Section 3.03-D-1&2 above.

- B. Installation shall be in accordance with applicable codes (i.e. NEC, ((NFPA 72))) local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- C. Perform all Work as indicated in the design documents and specifications.
- D. All low voltage cables shall be kept away from power circuits
- E. Any new or modified electrical power circuits shall be made by a licensed electrician.
- F. Where applicable – panel to be connected to the existing dedicated circuit for the Fire Alarm Panel.
- G. Double-pole, double-through (DPDT) recessed door contacts are to be installed at the top of the door frame for all exterior doors. Second contacts to be used and coordinated with HVAC system provider.
- H. All exterior roll-up doors are to have a floor mounted ruggedized door contact and a monitor module. Secure armored cable to prohibit being a trip hazard.
- I. All roof access hatches are to have ruggedized door contact and a monitor module. Secure armored cable to prohibit being a snag hazard.
- J. Motion detectors are to be mounted on single-gang back boxes (surface or flush) near the room corner aimed towards middle of the room. Install height shall be from 8' to 10' AFF and should not have casework below – to prevent the placement of material that blocks detector field of view. Detectors near window shall be located and aimed to minimize false activation.
- K. Monitoring modules are to be located at 10' AFF or less to allow for regular maintenance and shall not require special tools and/or equipment (i.e. scissor lift).
- L. All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation. Refer to the riser/connection diagram and/or approved shop drawings for specific system requirements. The design drawings shall be enforced when more stringent requirements are noted.
- M. All equipment shall be fastened firmly in place to walls or ceiling/floor assemblies. Fasteners and supports are to be of type and sized in accordance with drawings and specifications

INTRUSION DETECTION

28 31 00 - 7

- N. All panels and power supplies shall be labeled with 3/8 inch printed black lettering on white labels indicating AC electrical power panel, circuit breaker number and panel location.
- O. All detection devices shall be labeled with 1/4 inch printed black lettering on white labels indicating zone and/or point ID per design documents or approved shop drawings.
- P. Labeling material shall be heavy duty and appropriate for the environment in which it is installed.

### **3.6 WORKMANSHIP**

- A. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform Work with persons experienced and qualified to produce workmanship specified.
- C. Maintain quality control over suppliers and Subcontractors.
- D. Quality of workmanship is considered important. The District's Project Manager will have the authority to reject Work which does not conform to the Drawings and Specifications.

### **3.7 CABLE**

- A. Design, layout, size, and plan new cable runs as required.
- B. All cables shall be installed in accordance with Division 27 15 00 and code requirements.
- C. All wire and cable passing thru metalwork shall be sleeved by an approved grommet or bushing.
- D. Conduit/raceway fill shall not exceed 40 percent of interior cross-sectional area.
- E. Identify all cables at terminations and at every junction box. Identification shall be made with an approved permanent label, machine generated 1/4" black letters on white tape (Brady or equal.)
- F. Underground cable shall be rated for use.
- G. Neatly dress and tie all cabling.

### **3.8 CONDUIT AND RACEWAY INSTALLATION**

INTRUSION DETECTION

28 31 00 - 8

- A. Design, lay-out, size and plan new conduit and raceway systems as required.
- B. Install conduit and raceway in accordance with Division 27 requirements.

### **3.9 PENETRATIONS**

- A. Do not penetrate any roof, flashing, exterior wall, or parapet without prior approval from District's designated Construction Project representative.
- B. When penetrating a fire wall for passage of cables and/or conduit, always provide a UL listed fire-stop system that complies with code and the local authority having jurisdiction.
- C. Where conduit penetrates exterior walls, seal opening around conduit in an approved manner to make watertight.
- D. Refer to section 27 05 00 for additional requirements.

### **3.10 CUTTING AND PATCHING**

- A. The Contractor shall be responsible for all cutting, fitting or patching that may be required to complete the Work. Disturbed surfaces shall be returned to a paint ready condition.

### **3.11 DEMOLITION**

- A. See section 27 05 00 for additional requirements

### **3.12 PAINTING**

- A. See section 27 05 00 for requirements.

### **3.13 FIELD QUALITY CONTROL AND TESTING**

- A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- B. Upon reaching substantial completion, perform a complete test and inspection of the system. If found to be installed and operating properly, notify District of your readiness to perform the formal Test & Inspection of the complete system.
- C. Submit the Record Drawings (as-builts) to District for review prior to inspection.
- D. During the formal Test & Inspection (Commissioning) of the system, have personnel available with tools and equipment to inspect wiring, devices and system operation.

INTRUSION DETECTION

28 31 00 - 9

- E. The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with required codes
- F. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.
- G. If corrections are needed, the Contractor will be provided with a Punch-List of all discrepancies. Perform the needed corrections in a timely fashion.
- H. Notify District when ready to perform a re-inspection of the installation.
- I. The District and the inspector of record (IOR) shall perform all system functions as required by code to ensure proper and complete operation.
- J. When testing has been completed to the satisfaction of both the District and the IOR, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be forwarded to the District.
- K. After the satisfactory completion letter has been received, a continuous and fault free thirty (30) day "burn-in" period shall begin. Any fault shall reset the "burn-in" period to zero (0). Warranty shall commence at day 31 of a successful and continuous "burn-in" period.

### **3.14 INITIAL PROGRAMMING AND CONFIGURATION**

- A. Contractor shall provide programming and configuration of the Intrusion Detection system for full functionality and ready to communicate with monitoring stations.
- B. Contractor to coordinate with the District or the District's representative one week prior to final cutover for connectivity to monitoring stations. See section 3.03 for contact information.
- C. Contractor shall maintain hard copy worksheets which fully document the system program and configuration. Worksheets shall be kept up to date on a daily basis by Contractor until final Acceptance by District. Worksheets shall be subject to inspection and approval by District. Provide final copies to District prior to Project Close-out.

### **3.15 TRAINING**

INTRUSION DETECTION

28 31 00 - 10

- A. Contractor shall provide complete system operator and/or user training to insure adequate operator/user understanding.
- B. Training sessions to have an agenda, sign-in sheet and written instructional materials for all training attendees.

**3.16 FINAL DOCUMENT SUBMITTALS**

- A. See section 27 05 00 for requirements.



**APPENDIX-A**

**(UNLESS OTHERWISE SPECIFIED ON CONSTRUCTION DOCUMENT PLAN SHEETS)**

**INTRUSION ALARM COMPONENTS**

DESCRIPTION	MFG/MODEL	
Door Contact	GRI 195-12WG	
Roll-up Door Contact	INTERLOGIX/2202A-L	
Bosch Wall motion detector	BOSCH/ZX935Z	
Wall-mount gimbal	DSC/DM-W	
Ceiling-mount gimbal	DSC/DM-C	
Terminal/Barrier Strip	IDEAL INDUSTRIES 89-608	

**END OF SECTION**

**INTRUSION DETECTION**

**28 31 00 - 12**

**SECTION 28 46 00  
FIRE DETECTION AND ALARM**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Transmitters for communication with supervising station.
- C. Circuits from protected premises to supervising station, including conduit.
- D. Maintenance of fire alarm system under contract for specified warranty period.
- E. The fire alarm system shall consist of all necessary hardware equipment and software programming to perform the following functions:
  - 1. Fire alarm detection operations.
  - 2. Control and monitoring of smoke control equipment and other equipment as indicated in the drawings and specifications.
- F. Review the Drawings and Specifications for work and material provided by others that will affect work specified under this Section. Carefully coordinate with other trades, equipment suppliers, contractors, etc. as required to provide a high quality reliable installation with a minimum of construction delays. All work required to be re-accomplished due to lack of coordination shall be done at the Contractor's expense.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping: Materials and methods for work to be performed by this installer.
- B. Section 08 71 00 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.
- C. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.
- D. Section 23 33 00 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.
- E. REFERENCE STANDARDS
- F. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
  - 1. California Electrical Code CEC; 2022 Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.
- H. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. AMERICANS WITH DISABILITIES ACT (ADA)

1. All visual Notification appliances and manual pull stations shall comply with the requirements of the Americans with Disabilities Act or 2022 CBC, whichever is more stringent.

J. SUBMITTALS

1. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
2. Proposal Documents: Submit the following with cost/time proposal:
  - a. NFPA 72 "Record of Completion", filled out to the extent known at the time.
  - b. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
  - c. Certification by that the system design will comply with Contract Documents.
  - d. Proposed maintenance contract.
3. Drawings must be prepared using AutoCAD Release 2019.
  - a. Owner will provide floor plan drawings for 's use; verify all dimensions on Owner-provided drawings.
4. Evidence of designer qualifications.
5. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
  - a. Copy (if any) of list of data required by authority having jurisdiction.
  - b. NFPA 72 "Record of Completion", filled out to the extent known at the time.
  - c. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-14-6-1.1, and complete listing of software required.
  - d. System zone boundaries and interfaces to fire safety systems.
  - e. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
  - f. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
  - g. List of all devices on each signaling line circuit, with spare capacity indicated.
  - h. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
  - i. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
  - j. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.

- k. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
  - l. Certification by that the system design complies with Contract Documents.
- 6. Evidence of installer qualifications.
- 7. Evidence of instructor qualifications; training lesson plan outline.
- 8. Evidence of maintenance contractor qualifications, if different from installer.
- 9. Inspection and Test Reports:
  - a. Submit inspection and test plan prior to closeout demonstration.
  - b. Submit documentation of satisfactory inspections and tests.
  - c. Submit NFPA 72 "Inspection and Test Form," filled out.
- 10. Operating and Maintenance Data: See Section 01 78 00 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
  - a. Complete set of specified design documents, as approved by authority having jurisdiction.
  - b. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
  - c. Contact information for firm that will be providing contract maintenance and trouble call-back service.
  - d. List of recommended spare parts, tools, and instruments for testing.
  - e. Replacement parts list with current prices, and source of supply.
  - f. Detailed troubleshooting guide and large scale input/output matrix.
  - g. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
  - h. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.
- 11. Project Record Documents: See Section 01 78 00 for additional requirements; have one set available during closeout demonstration:
  - a. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
  - b. "As installed" wiring and schematic diagrams, with final terminal identifications.
  - c. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- 12. Closeout Documents:
  - a. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.

- b. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
  - c. Certificate of Occupancy.
  - d. Maintenance contract.
  - e. Report on training results.
- 13. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
  - a. See Section 01 60 00 - Product Requirements, for additional provisions.
  - b. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.
  - c. In addition to the items in quantities indicated in PART 2, furnish the following:
    - 1) All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
    - 2) One copy, of all software not resident in read-only-memory.
- K. QUALITY ASSURANCE
  - 1. Copies of Design Criteria Documents: Maintain at the project site for the duration of the project, bound together, an original copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction; deliver to Owner upon completion.
  - 2. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, , or installer , with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction
  - 3. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
    - a. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
    - b. Installer Personnel: At least 2 years of experience installing fire alarm systems.
    - c. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.

- d. Contract maintenance office located within 100 miles of project site.
- e. Certified in California as fire alarm installer.
- 4. Maintenance Contractor Qualifications: Same entity as installer.
- 5. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.
- 6. WARRANTY
  - a. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
  - b. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.
  - c. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Fire Alarm Control Units - Basis of Design: Honeywell Security & Fire Solutions/Notifier: [www.notifier.com](http://www.notifier.com). No known equal.
- B. Fire Alarm Control Units and Accessories:
  - 1. Honeywell Security & Fire Solutions/Notifier: [www.notifier.com/#sle](http://www.notifier.com/#sle).
  - 2. Provide control units made by the same manufacturer.
- C. Initiating Devices and Notification Appliances:
  - 1. Honeywell Security & Fire Solutions/Notifier: [www.notifier.com/#sle](http://www.notifier.com/#sle).
  - 2. Same manufacturer as control units.
- D. Substitutions: See Section 01 60 00 - Product Requirements.
  - 1. For substitution of products by manufacturers not listed, submit product data showing features and certification by that the design will comply with Contract Documents.

### **2.02 FIRE ALARM SYSTEM**

- A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
  - 1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
  - 2. Protected Premises: Entire building shown on drawings.
  - 3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
    - a. ADA Standards.
    - b. The requirements of the State Fire Marshal.
    - c. The requirements of the local authority having jurisdiction , which is Division of State Architects.
    - d. Applicable local codes.
    - e. Contract Documents (drawings and specifications).
    - f. NFPA 101.

- g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
  - 4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
  - 5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
  - 6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
  - 7. Program notification zones as directed by Owner.
  - 8. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
  - 9. Fire Command Center: Location indicated on drawings.
  - 10. Fire Alarm Control Unit: New, located at supervising station.
  - 11. Combined Systems: Do not combine fire alarm system with other non-fire systems.
- B. Supervising Stations and Fire Department Connections:
- 1. Public Fire Department Notification: By on-premises supervising station.
  - 2. Remote Supervising Station: UL-listed central station under contract to facility.
  - 3. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.
- C. Circuits:
- 1. Initiating Device Circuits (IDC): Class B, Style A.
  - 2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
  - 3. Notification Appliance Circuits (NAC): Class B, Style W.
- D. Spare Capacity:
- 1. Initiating Device Circuits: Minimum 25 percent spare capacity.
  - 2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
  - 3. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.
- E. Power Sources:
- 1. Primary: Dedicated branch circuits of the facility power distribution system.
  - 2. Secondary: Storage batteries.
  - 3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.

### **3.1 FIRE SAFETY SYSTEMS INTERFACES**

- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
  - 1. Sprinkler water control valves.
- B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
  - 1. Sprinkler water flow.
  - 2. Duct smoke detectors.
- C. HVAC:
  - 1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

## **2.04 COMPONENTS**

- A. General:
  - 1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
  - 2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.
- B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.
- C. Master Control Unit: As specified for Basis of Design above, or equivalent.
- D. Addressable Modules:
  - 1. Provide addressable modules suitable for connection to fire alarm control unit signaling line circuits.
  - 2. Unless otherwise indicated, use addressable modules only in clean, dry, indoor, nonhazardous locations.
  - 3. Relay Modules: Provide as indicated or as required to perform necessary functions via dry-contact interface. Where load exceeds module contact rating, provide accessory power isolation relays suitable for load as required.
  - 4. Products:
    - a. NOTIFIER FRM-1.
- E. Initiating Devices:
  - 1. Addressable Manual Pull Stations: NBG-12LX.
    - a. Provide 1 extra.
  - 2. Smoke Detectors: FSP-951 .
    - a. Sensor base: B300-6.
      - 1) Provide 1 extra.
  - 3. Duct Smoke Detectors: Notifier DNR Photoelectric type with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied.
  - 4. Heat Detectors: FST-951 W/B300-6.
- F. Notification Appliances:
  - 1. Weatherproof Speaker: System Sensor SPSRKLED.



- a. Provide 1 extra.
  2. Strobes: System Sensor SWLED.
    - a. Provide 1 extra.
  3. Strobes/Speaker: System Sensor SPSCWLED.
    - a. Provide 1 extra.
  4. Notification Appliance Circuit provides synchronization of strobes at a rate of 1Hz and operates horns with a Temporal Code Pattern operation. The circuit shall provide the capability to silence the audible signals, while the strobes continue to flash, over a single pair of wires. The capability to synchronize multiple notification appliance circuits shall be provided.
- G. NAC Power Extender: PSE-6 with batteries.
- H. The NAC Power Extender panel shall be a stand-alone panel capable of powering a minimum of 4 notification appliance circuits. Notification appliance circuits shall be Class B Style Y rated at 2 amps each. Panel shall provide capability to be expanded to 8 notification appliance circuits.
- I. The internal power supply & battery charger shall be capable of charging up 12.7 Ah batteries internally mounted or 18Ah batteries mounted in an external cabinet.
- J. Alarms from the host fire panel shall signal the NAC power extender panel to activate. The panel shall monitor itself and each of its NACs for trouble conditions and shall report trouble conditions to the host panel.
- K. Emergency Power Supply:
1. General: Components include battery, charger, and an automatic transfer switch.
  2. Battery: Sealed lead-acid or nickel cadmium type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm indicating devices in alarm or supervisory mode for a period of 5 minutes.
- L. Accessories: The contractor shall furnish the necessary accessories
- M. Circuit Conductors: Copper; provide 200 feet extra; color code and label.
- N. Locks and Keys: Deliver keys to Owner.
1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type
- O. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
  2. Provide one for each control unit where operations are to be performed.
  3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.

4. Provide extra copy with operation and maintenance data submittal.
- P. Storage Cabinet for Spare Parts and Tools: Steel with baked enamel finish, size appropriate to quantity of parts and tools.
  1. Padlock eye and hasp for lock furnished by Owner.
  2. Locate as directed by Owner.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Install in accordance with applicable codes, NFPA 72, CEC 2022, and the contract documents.
- B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:
  1. Factory trained and certified personnel.
  2. National Institute of Certification in Engineering Technologies (NICET) fire alarm level II certified personnel.
  3. Personnel licensed or certified by state or local authority.
- C. Conceal all wiring, conduit, boxes, and supports where installed in finished areas
- D. Install all wiring in conduit, 3/4" minimum. No exception.
- E. Water-Flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.
- F. Install instruction cards and labels.

#### **3.02 CLEANING AND ADJUSTING**

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.
- B. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

#### **3.03 INSPECTION AND TESTING FOR COMPLETION**

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

- E. Provide all tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- H. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
  - 1. Record all system operations and malfunctions.
  - 2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
  - 3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
  - 4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

#### **3.04 OWNER PERSONNEL INSTRUCTION**

- A. Provide the following instruction to designated Owner personnel:
  - 1. Hands-On Instruction: On-site, using operational system.
  - 2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
  - 3. Factory Instruction: At control unit manufacturer's training facility.
- B. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
  - 1. Initial Training: 1 session pre-closeout.
- C. Detailed Operation: Two-hour sessions for engineering staff; assume NICET level I qualifications or equivalent; combination of classroom and hands-on:
  - 1. Initial Training: 1 session pre-closeout.
- D. Maintenance Technicians: Detailed training for electrical technicians, on programming, maintaining, repairing, and modifying; factory training:
  - 1. Initial Training: One 3-day session, pre-closeout.
- E. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.
- F. Provide means of evaluation of trainees suitable to type of training given; report results to Owner.

#### **3.05 CLOSEOUT**

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
  - 1. Be prepared to conduct any of the required tests.

2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
3. Have authorized technical representative of control unit manufacturer present during demonstration.
4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
5. Repeat demonstration until successful.

### **3.06 MAINTENANCE**

- A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.
- C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
  1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
  2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
  3. Record keeping required by NFPA 72 and authorities having jurisdiction.
- D. Provide trouble call-back service upon notification by Owner:
  1. Provide on-site response within 24 hours of notification.
  2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
  3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- E. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
- F. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.
- G. Comply with Owner's requirements for access to facility and security.

## **SECTION 31 10 00 – SITE CLEARING**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. Remove surface debris.
- B. Remove paving, curbs, foundations and surface improvements.
- C. Clear site of plant life and grass.
- D. Remove trees and shrubs.
- E. Remove root system of trees and shrubs.
- F. Temporary Erosion and Sedimentation Control
- G. Post Construction Stormwater Management.

#### **1.02 SUBMITTALS**

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

#### **1.03 REGULATORY REQUIREMENTS**

- A. Conform to applicable codes for disposal of debris. Burning debris on site not permitted.
- B. Coordinate clearing work with utility companies.

### **PART 2 - PRODUCTS**

#### **2.01 SOIL MATERIALS**

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earthwork."
  - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.
- B. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Verify that existing plant life and features designated to remain are tagged or identified.

### **3.02 PROTECTION**

- A. Protect utilities that are designated to remain from damage.
- B. Protect trees, plant growth and features designated to remain as final landscaping.
- C. Protect bench marks and designated existing structures from damage or displacement.
- D. Erect barricades in accordance with Title 8, Subchapter 4, Construction Safety Orders, California Code of Regulations.
- E. Protect existing items not indicated to be altered.

### **3.03 CLEARING**

- A. Clear areas required for access to site and execution of Work.
- B. Remove paving, curbs, foundations and surface improvements. Patch and repair surfaces not indicated to be removed.
- C. Remove trees and shrubs indicated. Remove stumps, main root ball, root system to full depth.
- D. Clear undergrowth, grass and deadwood. Protect plant material not scheduled for removal.
- E. Keep site free of dust by sprinkling with water. Maintain adequate water trucks, hoses and water supply.
- F. The limits of clearing and grubbing shall be the area of new construction
- G. Remove all trash, rubbish and all other material not suitable for construction operations.
- H. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
- I. Use only hand methods for grubbing within tree protection zone.
- J. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
  - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to 90 percent of maximum dry density per ASTM D1557. Bring grade to match surrounding surfaces.

3.04 CONSTRUCTION EROSION AND SEDIMENTATION CONTROL (SITE PREREQUISITE)

- A. Comply with site erosion control plan that follows best management practices outlined by State Water Resources Control Board (WRCB) to comply with Stormwater Construction Activities General Permit. The plan shall meet the following objectives:
  - 1. Prevent loss of soil during construction by storm water runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.
  - 2. Prevent sedimentation of storm sewer or receiving streams and/or air pollution with dust and particulate matter.

3.05 REMOVAL

- A. Remove debris, rock and extracted plant life from site as work progresses. Dispose legally.
- B. Burial of removed materials not permitted.
- C. Use of Owner's disposal system not permitted. Do not use disposal system belonging to any other property Owner.
- D. Loose fill material, buried trash, abandoned underground structures or deleterious materials of any kind encountered shall be identified and removed to expose natural earth.

**END OF SECTION**

## **SECTION 31 22 00.10 - EARTHWORK**

### **PART 1 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Earth preparation outside building areas.

#### **1.02 REFERENCE STANDARDS**

- A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.
- B. California Code of Regulations, Title 8, Industrial Relations, Construction Safety Orders, Division 1, Chapter 4, Subchapter 4, Article 6 Excavations.
- C. Cal-OSHA: California Occupational Safety and Health Act, Title 8, Division 1, Chapter 3.2.
- D. ASTM D 1557 Laboratory compaction characteristics of soil using modified effort.

#### **1.03 SUBMITTALS**

- A. Compaction Report indicating requirements per ASTM D1557.
- B. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

#### **1.04 GENERAL REQUIREMENTS**

- A. Existing Conditions: Contractor shall examine site of Work and verify existing conditions under which work will be performed, including subsurface conditions.
- B. Drainage and Pumping: Maintain excavations and site free from water throughout work. Run surface water or seepage to sumps with float-switch controlled pumps. Pump to drainage system as approved by Architect.
- C. Protection: Provide and maintain protection to retain earth banks and protect adjoining existing monuments, grades and structures from caving, sliding, erosions or other damage and suitable forms of protection against bodily injury or property damage.
- D. Bulkheads and shoring shall conform to Occupational Safety and Health Act Construction Safety Orders, Title 8, Industrial Relations, California Code of Regulations.
- E. Provide barricades and berms at top of slopes to prevent water from flowing over top.



- F. Geotechnical Investigation has been prepared under direction of Owner. Investigation is hereby referenced as information for Work of this Section. Architect assumes no responsibility for conclusions Contractor may draw from information provided. The contractor must obtain approval for any and all deviations from the Contract Documents. Copy of investigation is available at Owner's office.
- G. Borrow. Fill, backfill, aggregate base, and other soil materials obtained from off-site sources shall be sampled and tested in compliance with California EPA Department of Toxic Substances Control recommendations to prevent the importation of contaminated materials to the Site.
  - 1. Testing Frequency
    - a. For borrow up to 1,000-cu.yd, conduct 1 test for each 250-cu.yrds.
    - b. For borrow between 1,001- and 5,000-cu.yd; conduct 4 tests for first 1,000-cu.yd., if material tests acceptable, conduct 1 test for each additional 500-cu.yrds.
    - c. For borrow over 5,000-cu.yds, conduct 12 tests during import of first 5,000-cu.yd, if material tests acceptable, conduct 1 test for each additional 1,000-cu.yds.
  - 2. Owner's Testing Laboratory shall take samples at source, conduct testing and evaluate test results prior to delivery.
  - 3. Conduct tests for lead and other heavy metals, asbestos, PCB's, pesticides, herbicides, VOCs, and semi-VOCs.
  - 4. When detectable quantities of hazardous materials are found, determine the risk to human health, the environment, or both using the DTSC Preliminary Endangerment Assessment Guidance Manual.
  - 5. Do not import soils, that exhibit a known risk to human health, the environment, or both.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. Excavated material, Imported Fill and Backfill: As specified in Section 31 23 23 and as approved by Geotechnical Engineer prior to placement on site.

## **PART 3 - EXECUTION**

### **3.01 PRE-CONSTRUCTION INSPECTION**

- A. Inspection of Site: Inspect entire site prior to commencing work and determine character of materials to be encountered and all conditions affecting Work.
- B. Existing Site Conditions: Verify location of existing underground structures and facilities (if any) and take adequate precautions to avoid damage to any active service or structure.
- C. Repair or replace property damaged by Work of this Section immediately.
- D. Piping and conduit encountered shall be adequately supported and protected until permanent support is provided or removal of same is approved by Architect.

- E. Existing Utilities: After approval of Architect, totally remove abandoned pipes and utilities found in excavations. Cap or plug at both ends all abandoned utility piping, conduit and lines encountered to provide a complete seal. Provide plugs or seals of concrete or threaded caps unless otherwise approved.
- F. Support and protect existing pipes and conduits where required during construction.
- G. Site Clearing: Conform to Section 31 10 00.
- H. Loose fill and natural on-site soils that are approved by Geotechnical Engineer may be stock-piled and used as fill material.
- I. After clearing and removal of loose fill, exposed surfaces shall be inspected and approved by Geotechnical Engineer prior to placing fill.
- J. Backfilling: Conform to Section 31 23 23.

### 3.02 STAKING AND GRADES

- A. Lay out work, establish necessary markers, bench marks, grading stakes, and other stakes as required.
- B. Existing and finish elevations are shown on the drawings, and unless inconsistencies therein are brought to the attention of the Architect in writing prior to commencement of the construction, the Contractor will be held responsible for the proper location and elevation of all work.

### 3.03 SITE PREPARATION

- A. Building areas shall be those areas indicated on grading plan that includes building area and distance of 5 feet minimum beyond footing lines, including covered walks. Excavation for building areas shall be as specified in Section 31 23 16.0.
- B. Over-excavate to depths required by the Geotechnical Investigation Report. Scarify or blade mix exposed soil to depth below exposed grade as detailed in Geotechnical Report.
- C. Geotechnical Engineer shall inspect scarified areas.
- D. After approval has been received from Geotechnical Engineer to proceed, bring soil mix to optimum moisture content and re-compact to 90 percent of maximum dry density per ASTM D 1557. Geotechnical Engineer shall test and approve results.
- E. Bring grade to sub-grades indicated or to accommodate conditions in 8 inches maximum loose lifts. Compact to 90 percent of maximum dry density per ASTM D1557.
- F. No jetting or flooding permitted.

### 3.04 INSPECTION

- A. Grading operations shall be inspected by Geotechnical Engineer. No fill shall be placed on any prepared surface until that surface has been inspected and approved by Geotechnical Engineer.
- B. Completed earthwork including cuts, fills, and earth bank slopes (cut or fill) shall be inspected by Geotechnical Engineer to determine suitability of exposed soils.

### 3.05 SEASONAL LIMITS

- A. No fill material shall be placed, spread or rolled while it is frozen or thawing or during unfavorable weather conditions. When Work is interrupted by heavy rain, fill operations shall not be resumed until field tests by Geotechnical Engineer indicate that moisture content and density of fill are as previously specified.

### 3.06 EXCAVATION FOR FOUNDATIONS

- A. Conform to Section 31 23 16.

### 3.07 EARTH BANK SLOPES

- A. Earth banks shall be sloped as shown on grading plan (2:1 Max).

### 3.08 TOLERANCES

- A. Perform rough grading to grades indicated, plus or minus 0.1 foot. Where grades are not indicated, grade uniformly level or slope between points for which elevations are given or from such points to existing grades with due allowance for adequate drainage and subsequent materials.
- B. Grading at Asphaltic Concrete Areas: Rough grade soil to elevation to conform to specified depth of base and pavement.
- C. Place necessary fill to bring sub-grade to proper elevations. Fill shall be placed as Compacted Fill.

### 3.09 TRENCHING FOR UTILITIES

- A. Conform to Section 31 23 17.

### 3.10 STOCKPILING OF FILL MATERIAL

- A. Fill: Soil removed that is suitable for fill shall be stockpiled separately on site.
- B. Stockpile Locations: Materials shall be stockpiled in locations approved by Architect and convenient for future placing, causing least disturbance to site and away from areas of actual building construction.

### 3.11 FIELD QUALITY CONTROL

- A. Testing and Inspection: Owner will engage a qualified independent Geotechnical Engineer to perform field quality-control testing and inspections. Do not proceed with concrete placement without approval of Geotechnical Engineer.
- B. Testing agency will test compaction of soils in place according to ASTM D1557, and ASTM D2937 as applicable. Tests will be performed at the following locations and frequencies:
  - 1. Paved Areas: At sub-grade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area, but in no case fewer than 3 tests.
  - 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
- C. Frequency of Tests: Geotechnical Engineer may make as many tests as are necessary to ensure specified results.
- D. When testing agency reports that sub-grades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; re-compact and retest until specified compaction is obtained.

### 3.12 DISPOSAL OF EXCESS MATERIAL

- A. Legally dispose of excess materials. Disposal shall be in areas off Owner's property, unless otherwise approved by Architect.

### **END OF SECTION**

## **SECTION 31 23 17 - TRENCHING**

### **PART 1 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Excavate trenches for utilities.
- B. Compacted bedding.
- C. Backfilling and compaction to required elevations.
- D. Slurry concrete.

#### **1.02 REFERENCE STANDARDS**

- A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.
- B. ASTM C150 - Portland Cement.
- C. ASTM C494 - Chemical Admixtures for Concrete.
- D. ASTM D1557 - Laboratory compaction characteristics of soil using modified effort.
- E. SSPWC - Standard Specifications for Public Works Construction, Latest Edition.
- F. California Code of Regulations, Title 8, Industrial Relations, Construction Safety Orders, Division 1, Chapter 4, Subchapter 4, Article 6 Excavations.
- G. Cal-OSHA: California Occupational Safety and Health Act, Title 8, Division 1, Chapter 3.2.
- H. California Public Contract Code, Section 7104 - Public Works Contracts for Digging Trenches or Excavations; Notice on Discovery of Hazardous Waste or Other Unusual Conditions; Investigations; Change Orders; Effect on Contract.
- I. California Labor Code, Section 6705 - Public Works Contracts requiring detailed plans for shoring, bracing, sloping, indicating protection from caving ground for trenching work in excess of 5' deep and contract amounts stipulated therein.

#### **1.03 SUBMITTALS**

- A. The Contractor shall submit in advance of excavation, for acceptance by the Owner's civil or structural engineer, detailed plan(s) showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of trenches more than 5 feet in depth. If such plan(s) varies from the shoring system standards, the plan shall be prepared by a registered civil or structural engineer.

#### 1.04 QUALITY ASSURANCE

- A. Verify survey benchmark and intended elevations for Work.
- B. Borrow. Fill, backfill, aggregate base, and other soil materials obtained from off-site sources shall be sampled and tested in compliance with CA EPA Department of Toxic Substances Control recommendations to prevent the importation of contaminated materials to the Site.
  - 1. Testing Frequency
    - a. For borrow up to 1,000-cu.yd, conduct 1 test for each 250-cu.yrds.
    - b. For borrow between 1,001- and 5,000-cu.yrd; conduct 4 tests for first 1,000- cu.yrd, if material tests acceptable, conduct 1 test for each additional 500-cu.yrds.
    - c. For borrow over 5,000-cu.yrds, conduct 12 tests during import of first 5,000-cu.yrd, if material tests acceptable, conduct 1 test for each additional 1,000-cu.yrds.
  - 2. Owner's Testing Laboratory shall take samples at source, conduct testing and evaluate test results prior to delivery.
  - 3. Conduct tests for lead and other heavy metals, asbestos, PCB's, pesticides, herbicides, VOCs, and semi-VOCs.
  - 4. When detectable quantities of hazardous materials are found, determine the risk to human health, the environment, or both using the DTSC Preliminary Endangerment Assessment Guidance Manual.
  - 5. Do not import soils, that exhibit a known risk to human health, the environment, or both.

#### 1.05 SOILS INFORMATION

- A. Geotechnical Investigation has been prepared under direction of Owner. Investigation is hereby referenced as information for Work of this Section. Architect assumes no responsibility for conclusions Contractor may draw from information provided. The contractor must obtain approval for any and all deviations from the Contract Documents. Copy of investigation is available at Owner's office.

### **PART 2 - PRODUCTS**

#### 2.01 FILL AND BEDDING MATERIALS

- A. Sand: Sand shall consist of natural or manufactured granular material, or a combination thereof, free of deleterious amounts of organic material, mica, loam, clay and other substances not suitable for the purpose intended. Conform to Subsection 200-1.5.5, SSPWC, for gradation as required for Portland Cement Concrete, sand must achieve compaction of a minimum 90 percent.
- B. Imported Fill: Granular, free of debris, no gravel larger than 3 inches in any dimension, non-expansive, approved by the Architect prior to placement on the site.
- C. Slurry Concrete:
  - 1. Slump: Between 4 inches and 6 inches.

2. Aggregate: 40 percent sand by weight, 60 percent pea gravel, minimum 1/4 inch, maximum 5/8 inch.
  3. Portland Cement: ASTM C150, 2-sack mix (2 sacks of cement per cubic yard).
  4. Admixture: Calcium Chloride free, in proportions not to exceed the manufacturer's recommendations.
  5. Sufficient water shall be added to produce a fluid, workable mix that will flow and can be pumped without segregation of aggregate. Material shall be mechanically mixed until the cement and water are thoroughly dispersed.
- D. Stockpiled Fill: Onsite soils, stored separately on the site, approved for re-use by the Architect.
- 2.02 ACCESSORIES
- A. Underground Warning Tape: Metallic Detection Tape, aluminum core, 6 inches wide AASHTO specification colors, by Safety Sign Company, Cleveland, OH, or equal.
  - B. Color Coding and Lettering: as required for type of underground utility.

### **PART 3 - EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify fill material to be reused is acceptable to the Geotechnical Engineer.

#### **3.02 PREPARATION**

- A. Identify required lines, levels, contours and datum.
- B. Backfill with approved fill and compact to density equal to or greater than requirements for subsequent backfill material.
- C. Prior to commencement of trenching operations, notify Underground Service Alert of Southern California (800) 422-4133, [Northern California (800) 642-2444], Monday through Friday, 7:00 A.M. to 5:00 P.M.

#### **3.03 EXCAVATION**

- A. Conform to Construction Safety Orders, Title 8, CCR, For Sloping, Benching, Shoring, Bracing, Protective Systems, and Shafts.
- B. Conform to Section 7104, Public Contract Code. Promptly notify Owner of any contact with hazardous materials or differing conditions.
- C. Conform to Section 6705, Labor Code. Provide detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of trenches.
- D. Excavate subsoil required for utilities. Trenches shall be level or parallel to finish grade unless designated on drawings to be installed to specific gradient.

- E. Cut trenches sufficiently wide to enable installation of utilities and allow inspection.
- F. Sewer and water lines shall not be installed in the same trench unless they shall be separated by 12 inches vertically. Cross-over water lines shall also be separated 12 inches vertically from storm drainage pipe.
- G. Excavation shall not interfere with normal 45 degree bearing splay of foundations. Parallel trenches, no closer than 18 inches from building foundations.
- H. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.
- I. Remove lumped subsoil, boulders and rock.
- J. Correct unauthorized excavation.
- K. Stockpile approved excavated material in area designated on site and remove excess material not being used from site.

#### 3.04 BEDDING

- A. Support pipe and conduit during placement and compaction of bedding fill. Provide uniform bearing along entire length. Conform to Section 306, SSPWC.
- B. Bedding: Place and compact materials in continuous layers not exceeding 6 inches compacted depth, ASTM D1557.

#### 3.05 BACKFILLING

- A. Backfill trenches to contours and elevations with unfrozen materials.
- B. Fill areas will be inspected, tested and approved by Geotechnical Engineer.
- C. Soil Fill over Bedding: Place and compact material in continuous layers as scheduled, compacted to ASTM D1557.
- D. Employ placement method that does not disturb or damage conduit, ducts or piping in trench.
- E. Maintain optimum moisture content of backfill materials to attain required compaction density. When operations are interrupted by rain, do not resume Work until field tests indicate that moisture content and density of fill are as previously specified.
- F. Remove surplus backfill materials from site and dispose legally.
- G. Leave fill material stockpile areas completely free of excess fill materials.
- H. Minimum Cover Over Piping, Conduits or Duct Banks: 24 inches.
- I. Lay out and install or otherwise confirm invert elevations of all gravity flow systems to avoid conflict with other sub-surface structures or utilities of any kind. Adjust elevations or layout of pipes, conduits or duct banks to permit the required gravity flow.



- J. Jetting for utility trenching compaction may be used outside building perimeter and only when recommended by Geotechnical Engineer, in accordance with Section 306 SSPWC.
  - K. Pressurized piping shall be installed level, or shall be installed parallel to finish grades unless designated on the Drawings to be installed to specific gradients.
- 3.06 <THRUST BLOCKS
- A. Install at turns of water lines and as indicated in drawings.
- 3.07 TOLERANCES
- A. Top Surface of Backfilling Under Paved Areas: 0.1 ft from required elevations.
  - B. Top Surface of General Backfilling: Plus or minus 0.1 ft from required elevations.
- 3.08 FIELD QUALITY CONTROL
- A. Backfill materials and operations will be inspected and approved by Geotechnical Engineer [Testing Laboratory] including earth bank slopes (cut or fill).
  - B. Tests, analysis and compaction of fill material will be performed in accordance with ASTM D1557.
  - C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
  - D. Frequency of Tests: Geotechnical Engineer [Testing Laboratory] may make as many tests as are necessary to ensure specified results.
- 3.09 PROTECTION OF FINISHED WORK
- A. Protect finished Work.
  - B. Recompress fills subjected to vehicular traffic.
- 3.10 TEMPORARY PROTECTION OF UNFINISHED WORK
- A. Trenching for placement of underground utilities shall be covered and protected with steel trench plates during non-work hours [and during school session hours.] Adequate warnings and protection indication of open trenches during work hours must be provided for project safety.
- 3.11 SCHEDULE
- A. Storm and Sanitary Piping:
    - 1. Begin laying pipe at low point of system with bells facing upstream.
    - 2. Bedding Fill: Sand or cohesionless soil, 2-inch minimum thickness below piping. For PVC or HDPE pipe, minimum thickness above top of piping shall be 6

- inches, compacted to 90 percent. For RCP, sand or cohesionless soil shall extend up to at least the spring line of the pipe, compacted to 90 percent.
3. Cover with native fill in 8-inch lifts to specified subgrade elevations, compact to 90 percent.
  4. Bury warning tape marked "Caution Sewer Line" 12 inches above all piping. Align tape parallel to and within 3 inches of the centerline of the piping.
- B. Water Piping and Gas Piping:
1. Bedding Fill: Sand or cohesionless soil, 2-inch minimum thickness below piping. Minimum thickness above top of piping, 6 inches, compacted to 90 percent.
  2. Cover with native fill in 6-inch lifts to specified subgrade elevation, compact to 90 percent.
  3. Observe joints at pressure tests.
  4. Bury warning tape marked "Caution Buried Gas (or "Water") Line" 12 inches above all trenching. Align tape parallel to and within 3 inches of the centerline of trench.
- C. Fire Lines:
1. Bedding Fill: Sand or cohesionless soil, minimum 2-inch thickness under piping. Minimum thickness above top of piping, 6 inches, compacted to 90 percent.
  2. Cover with native fill in 6-inch lifts to specified subgrade elevation, compact to 90 percent.
  3. Bury warning tape marked "Caution Buried Water Line" 12 inches above all trenching. Align tape parallel to and within 3 inches of the centerline of trench.

## **END OF SECTION**

## **SECTION 31 23 23 - BACKFILLING**

### **PART 1 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Authorized types of fill.
- B. Building area backfilling to subgrade elevations.

#### **1.02 REFERENCE STANDARDS**

- A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.
- B. ASTM D1557 - Laboratory compaction characteristics of soil using modified effort.
- C. SSPWC - Standard Specifications for Public Works Construction, Latest Edition.
- D. Chapters 18A and 33, California Building Code, 2016.
- E. CSS - Caltrans Standard Specifications, Latest Edition.

#### **1.03 QUALITY ASSURANCE**

- A. Borrow. Fill, backfill, aggregate base, and other soil materials obtained from off-site sources shall be sampled and tested in compliance with CA EPA Department of Toxic Substances Control recommendations to prevent the importation of contaminated materials to the Site.
  - 1. Testing Frequency
    - a. For borrow up to 1,000-cu.yrd, conduct 1 test for each 250-cu.yrds.
    - b. For borrow between 1,001- and 5,000-cu.yrd; conduct 4 tests for first 1,000- cu.yrd, if material tests acceptable, conduct 1 test for each additional 500-cu.yrds.
    - c. For borrow over 5,000-cu.yrds, conduct 12 tests during import of first 5,000-cu.yrd, if material tests acceptable, conduct 1 test for each additional 1,000-cu.yrds.
  - 2. Owner's Testing Laboratory shall take samples at source, conduct testing and evaluate test results prior to delivery.
  - 3. Conduct tests for lead and other heavy metals, asbestos, PCB's, pesticides, herbicides, VOCs, and semi-VOCs.
  - 4. When detectable quantities of hazardous materials are found, determine the risk to human health, the environment, or both using the DTSC Preliminary Endangerment Assessment Guidance Manual.
  - 5. Do not import soils that exhibit a known risk to human health, the environment, or both.

## **PART 2 - PRODUCTS**

### **2.01 FILL MATERIALS**

- A. This Section establishes standards of quality for backfill materials to be used as approved by Geotechnical Engineer in accordance with Chapter 18A CBC, Section 1803A.2 and Appendix J Section J107, California Building Code, and as scheduled in other Sections of this specification.
- B. Crushed Rock and Rock Dust: Crushed rock and rock dust shall be product of crushing rock or gravel. Portion of material that is retained on a 3/8 inch sieve shall contain at least 50 percent of particles having three or more fractured faces. Not over 5 percent shall be pieces that show no such faces resulting from crushing. Of that portion which passes 3/8 inch sieve but is retained on No. 4 sieve, not more than 10 percent shall be gravel particles. Crushed rock shall conform to 3/4 inch sieve size in accordance with Subsection 200-1.2, SSPWC, Crushed Rock Gradation Table.
- C. Pea Gravel: Natural stone; washed, free of clay, shale, organic matter; graded to the following:
  - 1. Minimum Size: 1/4 inch.
  - 2. Maximum Size: 5/8 inch.
- D. Sand: Sand shall consist of manufactured granular material, or combination thereof, free of deleterious amounts of organic material, mica, loam, clay and other substances not suitable for purpose intended. Conform to Section 200-1.5.5, SSPWC, for gradation as required for Portland Cement Concrete, sand must achieve compaction of a minimum 90 percent.
- E. Crushed Aggregate Base: As specified in Section 32 12 16. Crushed rock and rock dust conforming to requirements of Section 200-1.2, SSPWC, with 3/8 inch sieve requirement waived, or Class 2 aggregate base as defined in Section 26, CSS.
- F. Imported Fill: Clean granular, free of debris, no rock larger than 3 inches in any dimension, non-expansive, approved by Geotechnical Engineer prior to placement on site.
- G. Concrete: Structural, as specified in Section 03 30 00.
- H. Concrete Slurry: as specified in Section 31 23 17.
- I. Stockpiled Fill: On-site soils, stored separately on site, approved for re-use by Geotechnical Engineer.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Verify fill materials to be reused or imported are acceptable to Architect.
- B. Verify foundation perimeter drainage installation has been inspected and approved.

### 3.02 BACKFILLING

- A. Backfill and compact areas to contours and elevations with unfrozen materials. Remove debris from areas to receive backfills.
  - 1. Compaction: ASTM D1557, Compact to 90 percent of maximum dry density.
  - 2. Floor slabs shall be in place a minimum of 7 days before backfill is placed against walls.
- B. Fill areas and types of fill shall be inspected, tested and approved by Testing Laboratory or Geotechnical Engineer.
- C. Employ placement method that does not disturb or damage foundation perimeter drainage, foundation waterproofing and protective cover or utilities in trenches. Do not commence backfill until such work is in place, inspected and approved.
- D. Maintain optimum moisture content of backfill materials to attain required compaction density. When operations are interrupted by rain, do not resume work until field tests indicate that moisture content and density of the fill are as previously specified.
- E. Slope grade away from building minimum 2 inches in 10 ft, unless noted otherwise.
- F. Make grade changes gradual. Blend slope into level areas.
- G. Remove surplus backfill materials from site.
- H. Leave fill material stockpile areas completely free of excess fill materials.
- I. Compaction Equipment: Wherever feasible, perform compaction with approved power-driven equipment such as rollers and sheeps-foot compactors. Compact areas inaccessible to rollers with pneumatic tampers or other approved compactors.
- J. Flooding and jetting is not permitted.

### 3.03 TOLERANCES

- A. Top Surface of Backfilling Subgrade: Within 0.05 feet from required elevations.

### 3.04 FIELD QUALITY CONTROL

- A. No fill shall be placed on any prepared surface until that surface has been inspected and approved by Geotechnical Engineer.
- B. If tests indicate work does not meet specified requirements, remove work, replace and retest. Cost of retests shall be paid by Owner and deducted from contract sum by Change Order.
- C. Frequency of Tests: Architect may require as many tests as are necessary to ensure specified results.

3.05 PROTECTION OF FINISHED WORK

- A. Protect finished Work.
- B. Recompect fills subjected to and damaged by vehicular traffic.

**END OF SECTION**

## **SECTION 32 12 16 - ASPHALTIC CONCRETE PAVING**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. Section Includes
  - 1. Asphaltic concrete paving and surface sealer.
  - 2. Sub-base preparation.
  - 3. Aggregate base course.
  - 4. Concrete parking bumpers.
  - 5. Asphalt speed bumps.
  - 6. Plastic parking bumpers and speed bumps.
  - 7. Slurry sealing.
  - 8. Patching and repair of asphaltic concrete paving.
- B. Related Sections
  - 1. Section 01 35 43, Special Environmental Requirements.
  - 2. Section 32 17 23, Pavement Marking.
  - 3. Section 32 18 28, Synthetic Running Track.

#### **1.02 REFERENCE STANDARDS**

- A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.
- B. ASTM - American Society for Testing and Materials
  - 1. ASTM D977 - Standard Specification for Emulsified Asphalt
  - 2. ASTM D1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort.
  - 3. ASTM D2026 - Standard Specification for Cutback Asphalt
  - 4. ASTM D3910 - Design, Testing, and Construction of Slurry Seal
- C. AASHTO - American Association of State Highways and Transportation Officials
  - 1. AASHTO MP 1 - Performance Graded Asphalt Binders
- D. CSS - Caltrans Standard Specifications
- E. ISSA - International Slurry Seal Association
  - 1. ISSA A105 - Recommended Performance Guidelines for Emulsified Asphalt Slurry Seal
- G. SSPWC - Standard Specifications for Public Works Construction

#### **1.03 QUALITY ASSURANCE**

- A. Perform Work in accordance with Sections 200, 203 and 302, SSPWC.

- B. Obtain materials from same source throughout, using batch plant method for proportioning and mixing.

#### 1.04 SUBMITTALS

- A. Product data, mix design per Section 01 30 00, Administrative Requirements.
- B. Special Environmental Requirements Form, found in Appendix A of Section 01 35 43 Special Environmental Requirements. Provide the following information for aggregate for base course.
  - 1. Recycled Content.
  - 2. Local/Regional Materials.

#### 1.05 ENVIRONMENTAL REQUIREMENTS

- A. Do not place asphalt when base surface temperature is less than 40 degrees F or surface is wet or frozen,
- B. Conformation to AQMD, Local Regulations.

#### 1.06 SOILS INFORMATION

- A. Geotechnical Investigation has been prepared under direction of Owner. Investigation is hereby referenced as information for Work of this Section. Architect assumes no responsibility for conclusions Contractor may draw from information provided. The contractor must obtain approval for any and all deviations from the Contract Documents. Copy of investigation is available at Owner's office.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Acceptance at site.

### **PART 2 - PRODUCTS**

#### 2.01 MATERIALS

- A. Asphalt Binder: SSPWC 203-1 or AASHTO MP1, Performance Grade 64-10 South and Central Coast, Inland Valleys Regions, and shall conform to the testing requirements of Table 203-1.2 (A), Section 203 SSPWC.
- B. Asphalt Aggregate: Uniformly graded in accordance with Section 203-6.2.2, SSPWC.
- C. Class 2 Aggregate Base as defined in Section 26, CSS.



## 2.02 ACCESSORIES

- A. Primer: ASTM D2026, cutback type, slow curing, Grade SC-250.
- B. Tack Coat: ASTM D977, slow setting emulsified asphalt SS-1H.
- C. Seal Coat: Conform to Section 203-9, SSPWC.
  - 1. GUARDTOP by Industrial Asphalt/Vulcan Material Co., Inc., Irwindale, CA.
  - 2. SATIN SEAL by Blue Diamond Co., Long Beach, CA.
  - 3. Or equal, as approved in accordance with Division 01, General Requirements for Substitutions.
- D. Parking Bumpers:
  - 1. Precast concrete type, steel reinforced, air-entrained, 5000 psi, bars No. 3 minimum size. Bars shall extend to within 1-1/2 inches of ends of bumpers. Minimum bumper size: 6-inches high, 8-inches wide, 6-feet long unless otherwise indicated on Drawings. Provide chamfered corners, traverse drainage slots on underside, and a minimum of two factory-formed vertical holes through wheel stop for anchoring to substrate.
  - 2. Recycled Plastic Parking Bumpers: 72-inches L x 6-inches W x 4-inches H, including attachment accessories, Model STWHLSTP, color: yellow. By Barco Products Company, Batavia, IL. Or equal.]
  - 5. Installation adhesives: As recommended by parking stop and speed bump manufacturer for surface to which installed.
- F. Soil Sterilizer: Spike 80DF. Non-selective weed and grass killer, by Dow-Agro Sciences, Indianapolis, IN, EPA Reg. No. 62719-107, or equal, as approved in accordance with Division 01, General Requirements for Substitutions.
  - 1. Active Ingredients:
    - a. Tebuthiuron: 80%
    - b. Inert Ingredients: 20%
    - c. Total: 100%
- G. Headers: Foundation grade redwood, minimum 2- x 4-inches. Stakes shall be minimum 2- x 3-inches in accordance with Section 302-5.5 SSPWC.

## 2.03 ASPHALT PAVING MIX

- A. Use dry material to avoid foaming. Mix Uniformly.
- B. Mix: Surface Course; Section 203-6.4 SSPWC, 1/2-inch maximum aggregate size, medium gradation curve, as required by outside temperatures at time of laying.
  - 1. Single Course: C2 (Dense Medium) aggregate. Performance Grade 64-10 asphalt.
    - a. Areas where hand spreading is required: Use 3/8-inch mix.
    - b. Playground Areas: "Playground Mix", 3/8-inch mix D2 (Dense Fine), SSPWC Table 203-6.4.4.]
- C. Mix: Section 203-6.4 SSPWC, 3/4-inch asphalt base course, 1/2-inch asphalt surface course aggregate size.

1. Asphalt Base Course: B (Dense Medium Course), Performance Grade 64-10 asphalt. Thickness of 2-1/2 inches.
  2. Asphalt Surface Course: C2 (Dense Medium), Performance Grade 64-10 asphalt. Thickness of 1-1/2 inches.
- D. Recycled Asphalt Concrete (RAC), C2-PG 64-10 RAC and Reclaimed Asphalt Pavement (RAP) not allowed for on-site pavement.
- E. Slurry Mix Design: ISSA Type II
1. Type I: Maximum nominal size aggregate; 2.36 mm (No. 8). Application rate: 8 - 12 lbs/sq.yd. Residual Asphalt Content: 10 - 16%.
  2. Type II: Maximum nominal size aggregate; 4.75 mm (No. 4). Application rate: 12 - 20 lbs/sq.yd. Residual Asphalt Content: 7.5 - 13.5%.
  3. Type III: Maximum nominal size aggregate; 9.5 mm (3/8-inch). Application rate: 18 lbs/sq.yd. Residual Asphalt Content: 6.5 - 12%.]

## **PART 3 - EXECUTION**

### **3.01 SUB-GRADE**

- A. Bring areas to be surfaced to required subgrades by cutting and filling with suitable equipment.
- B. Scarify subgrade to minimum depth of 6-inches. Bring to optimum moisture content and compact to minimum 90 percent density in accordance with ASTM D1557 by rolling with power roller. Provide hard, even surface to receive subsequent base and paving.
- C. Finish subgrade to required grades with allowance for compression and for thickness of base course and finish paving thickness.

### **3.02 SOIL STERILIZATION**

- A. After sub-grade has been compacted and approved by Geotechnical Engineer, treat areas to be paved with specified soil sterilizer. Conform to the following:
  1. Apply 7.5 lbs. of solution per acre for each 15 gallons of water, spray apply per manufacturer's instructions.
- B. Exercise caution during storage of material and during application. Prevent injury to humans, animal life, adjacent plant life and property. Keep soil sterilization materials minimum three feet from tree wells or any plant life.
- C. Legally dispose of containers.

### **3.03 BASE COURSE**

- A. Place and compact aggregate base upon finished subgrade in conformance with

Section 301-2 SSPWC. Compaction: 95 percent.

- B. Thickness of Base after Compaction: As indicated on Drawings but not less than 4-inches if indicated.

#### 3.04 PREPARATION - TACK COATS

- A. Apply tack coat to contact surfaces of cold joints, curbs, gutters, manholes and adjacent materials, in conformance with Section 302-5.4, SSPWC.
- B. Coat surfaces of catch basin frames with oil to prevent bonding with asphalt pavement. Do not tack coat these surfaces.

#### 3.05 PLACING ASPHALT PAVEMENT - SINGLE COURSE

- A. Install redwood headers.
- B. Place asphalt in conformance with Section 302-5 SSPWC. Conform to temperature maximums and minimums specified therein. Materials shall not be applied which have cooled below lower limit allowable.
  - 1. Install 1/2-inch mix for single course asphalt pavement.
- C. Place to thickness as indicated on drawings but not less than 3 inches if not indicated.
- D. Install drainage grilles and frames in correct position and elevation.
- E. Compact pavement by rolling with equipment specified in Section 302-5.6, SSPWC. Do not displace or extrude pavement from position.
- F. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks, rock pockets, ridges or depressions.

#### 3.06 SEAL COAT

- A. Apply seal coat 30 days or more after surface course application, in accordance with manufacturer's recommendations.
- B. Apply seal coat to surface course in accordance with Section 302-8.2 SSPWC.
- C. Add water to specified seal coat material. When air temperatures of 90 degrees F or more are encountered during application, consult manufacturer for recommendations.
- D. If pavement surface exhibits imperfections noted Placing Asphalt Pavement above, as determined by the Architect, the addition of sand aggregate to seal coat, and amounts thereof, shall be as recommended by the manufacturer.
- E. A second application shall be made after first coat has dried to the touch. When sand is added to the first seal coat, two additional coats without extra sand shall be applied.

- F. Allow seal coat to dry before permitting traffic or striping.

### 3.08 PARKING BUMPERS

- A. Securely attach precast concrete parking bumpers into pavement with two 5/8-inch diameter galvanized solid rod anchors. Extend anchors 24-inches into ground. Apply adhesive to underside of concrete bumpers, as recommended by the manufacturer.
  - 1. Low-VOC emission type, heavy duty adhesives as recommended by the manufacturer or expansion-type steel bolts set in holes drilled into concrete paving.

### 3.09 ASPHALT CONCRETE SPEED BUMPS

- A. Construct hot-mix asphalt speed bumps over compacted pavement surfaces. Apply a tack coat unless pavement surface is still tacky and free from dust. Spread mix at a minimum temperature of 250 degrees F (121 degrees C).
- B. Tack Coat Application: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq.yd. (0.2 to 0.7 L/sq.m.).
- C. Asphalt Mix: Same as pavement surface-course mix.
- D. Before installation, mill pavement that will be in contact with bottom of speed bump. Mill to a depth of 1-inch (25mm) from top of pavement to a clean, rough profile.
- E. Place and compact hot-mix asphalt to cross section as indicated on Drawings or as specified below, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.
  - 1. Width: 1'-6", 3" high crown radius to 16".
  - 2. Paint speed bump yellow per Section 32 17 23, Pavement Markings.

### 3.10 SPOT PATCHING AND REPAIRS

- A. Patching: Saw cut perimeter patch and excavate existing pavement section to sound base. Scarify and recompact the upper 12-inches of subgrade to 90% of maximum density. Excavate rectangular or trapezoidal patches, extending 12-inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically.
  - 1. Tack coat faces of excavation and allow to cure before paving.
  - 2. Fill excavation with dense-graded, hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.
  - 3. Partially fill excavation with dense-graded, hot-mix asphalt base mix and compact while still hot. Cover asphalt base course with compacted, hot-mix surface layer finished with adjacent surfaces.]

### 3.11 PATCHING AND REPAIR OF ASPHALTIC CONCRETE PAVING

- A. Tack Coat: Apply uniformly to existing surfaces of previously constructed asphalt or

portland cement concrete paving to surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.05 to 0.15 gal.sq.yd. of surface.

1. Allow tack coat to cure undisturbed before paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

B. Preparation:

1. Subgrade Preparation: Scarify earth subgrade to a depth of not less than 6-inches, and compact to 90 percent of maximum density.
2. Moisten with water to approximate optimum moisture content, and while moist, roll until the surface is unyielding, with a power roller of such weight as to develop a pressure of not less than 200 pounds per linear inch of roller width.
3. Correct irregularities by dressing down or filling as may be required, to bring areas to true subgrade elevations.
4. Where filling is required, scarify the subgrade to bond the new material to the in-place material; use additional material as required, subject to the approval of the Architect, and provided by the Contractor.
5. Remove excess material from the site to a legal disposal area.

C. Compaction Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

E. Application General:

1. Finish elevations, extent of asphalt paving and locations of type of asphalt and class of base shall be as indicated and specified. Bring subgrade elevations sufficiently below the finish elevations of the paving so as to accommodate the thickness of paving and base.
2. Compaction expressed in percentages in this section refers to the maximum dry density determined by Test Method No. 2016-F as described in the Caltrans "Manual of Tests".

F. Application of Base Course

1. Placing Aggregate Subbase Coarse: Place sub-base course on the compacted sub-grade and compact in accordance with CALTRANS "Standard Specifications," Article 25-1.04. Finished surface of the sub-base at any point shall not vary more than 0.08 foot above or below the grade indicated.
2. Placing Aggregate Base Course: Place base course on the compacted aggregate sub-base course and compact in accordance with applicable provisions of CALTRANS "Standard Specifications," Sections 25 and 26. Use compacting equipment adequate for the size of the installation and capable of achieving the compaction specified.
3. Compact each layer to a relative compaction not less than 95% of that determined by Test Method No. Calif. 216.
4. Apply finished base course to a thickness which does not vary more than 0.05 foot from the planned thickness at any point. Reshape or rework, water, and thoroughly re-compact base that does not conform to the specified requirements.

G. Sterilant Application: Place herbicide below asphalt paving. Meet the applicable environmental control requirements. Apply as directed by the manufacturer's printed instructions just before application of the paving. Take special care to insure that

herbicide is not applied to any areas which are to be planted.

H. Placing Asphalt Concrete Surface:

1. Paint Binder: Before the surface course is laid, paint all vertical surfaces of curbs, gutters, and drainage structures and all cold or existing pavement joints with a paint binder at an approximate rate of 0.05 to 0.10 gallon per square yard.
2. Placing Asphaltic Concrete Surface Course: Place and compact asphaltic concrete in accordance with Standard Specifications, CALTRANS Section 39-5, 39-6, and 39-7.
3. Placing Asphaltic Concrete Surface Course: Spread asphaltic concrete mixture at a temperature of not less than 250 degrees F. Place by use of a self-propelled asphalt paving machine, except on small areas where inaccessibility precludes their use. On these small areas spread by means of a spreader box, or by hand methods.
  - a. Spread mixture in a single layer (two layers at Contractor's option) to such a thickness that, after receiving the final compaction, the finish paving shall have a minimum thickness as indicated.
4. Berms, curbs, and slow down strips shall be placed with an extrusion machine or other equipment capable of shaping and compacting the material to the required cross section.

I. Seal Coat:

1. Apply to all new asphaltic concrete paving, in accordance with SSPWC Standard Specifications, Section 302-8. Apply to all existing asphaltic concrete paving where indicated, in accordance with SSPWC Standard Specifications, Section 302-8. Dilute emulsion as directed with water not to exceed 20% of the total volume.
2. Thoroughly clean foreign matter off pavement before application. No emulsion shall be spread when the atmospheric temperature is less than 60 degrees F., or when weather conditions are unsuitable for drying.
3. Apply, just prior to "line" work, at rate of 0.10 gallon per square yard, at temperature between 100 and 140 degrees. If tackiness prevails, lightly dust affected areas with rock dust or fine sand.

J. Header Board Installation: Install header boards at perimeter of pavement with stakes spaced not over 24 inches on center unless otherwise indicated. Do not install header boards where asphaltic concrete paving abuts buildings, concrete walks or curbs, or other pavements.

K. Pavement Painting:

1. Allow seal coats to cure for ten days before applying paint.
2. Cleaning: Sweep and clean surface to eliminate loose material and dust.
3. Apply paint with mechanical equipment to produce uniform straight edges. Using painting equipment and templates specifically designed for this purpose. Protect adjoining work from damage.
4. Make lines 4" wide unless otherwise indicated.
5. Layout markings to exact requirements of Owner. Verify layout line widths, and colors prior to painting.

L. Field Quality Control:

1. Before seal coating, flood the paved areas with water to check drainage and

- surface irregularities. Replace, or overlay high and low spots in an acceptable manner and water test the paving again after corrections have been made.
2. Replace or repair deficient and damaged asphalt paving.
  3. All paving shall drain properly before being accepted. There shall be no variation greater than 1/4-inch plus or minus from a 10-foot straight edge, except at grade changes.]

### 3.12 TOLERANCES

- A. Thickness: Compact each paving course to produce the thickness indicated within the following tolerances:
  1. Base Course: Plus or minus 1/2-inch.
  2. Surface Course: Plus 1/4-inch, no minus.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straight edge applied transversely or longitudinally to paved areas:
  1. Base Course: 1/4-inch.
  2. Surface Course: 1/8-inch.
- C. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4-inch.

### 3.13 PROTECTION

- A. Protect asphalt paving against vehicular traffic before and for 48 hours following seal coating.

## END OF SECTION

## SECTION 32 13 13 - SITEWORK CONCRETE

### PART 1 - GENERAL

#### 1.01 SUMMARY

##### A. Section Includes

1. Cast-In-Place concrete pedestrian paving and sidewalks.
2. Curbs and gutters.
3. Concrete stairs, ramps and landings.
4. Light standard bases, fence post bases, flagpole bases, monument sign, railing footings, athletic equipment footings, and similar site structures.
5. Utility concrete pads.
6. Perimeter concrete curbing, mow strips, concrete drainage structures, swales.
7. Skateboard Deterrent Devices.
8. Integral Color concrete.
9. Dry Shake Color concrete.
10. Stain Concrete.
11. Stamped concrete.
12. Exposed aggregate finish.
13. Finish at exposed vertical surfaces.
14. Thrust Blocks.
15. Slurry Concrete.
16. Detectable Warnings
17. Vegetation Control

##### B. Related Sections:

1. Section 31 23 16 Excavation.  
Section 32 14 13, Porous Unit Pavers, Detectable Warnings (Truncated Domes) and Directional texture.
2. Section 32 17 26 Tactile/Detectable Warning Surface Tile  
Section 32 18 23, Synthetic Track and Field Surfacing.

#### 1.02 REFERENCE STANDARDS

- A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.
- B. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
- C. ACI 224.3R-95 - Joints in Concrete Construction
- D. ACI 318-14 - Building Code Requirements for Structural Concrete and Commentary, 2008 Edition.
- E. ACI 301 - Structural Concrete for Buildings.



- F. ASTM - American Society for Testing and Materials
  - 3. ASTM A185 - Steel Welded Wire Reinforcement, Plain, for Concrete
  - 1. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
  - 2. ASTM C33 - Concrete Aggregates
  - 3. ASTM C94 - Ready-Mixed Concrete
  - 4. ASTM C150 - Portland Cement
  - 5. ASTM C171 - Sheet Materials for Curing Concrete
  - 6. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete
  - 7. ASTM C618 - Coal Fly Ash and Raw or Calcinated Natural Pozzolan for use as a Mineral Admixture on Concrete
  - 8. ASTM C920 - Elastomeric Joint Sealants
  - 9. ASTM C979 - Pigments for Integrally Colored Concrete
  - 10. ASTM C1107 - Packaged Dry, Hydraulic - Cement Grout (Non-Shrink)
  - 11. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete, Paving and Structural Construction
  - 12. ASTM E1980-11 - Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.
- G. CBC - 2016 California Building Code and Supplements
  - 1. CBC-11 - CBC Chapter 11B, Accessibility to Public Buildings, Public Accommodations, Commercial Facilities and Publicly Funded Housing
  - 2. CBC Chapter 17A, Structural Tests and Special Inspections
  - 3. CBC Chapter 19A, Concrete [DSA]

### 1.03 SUBMITTALS

- A. Placement Schedule for approval: Provide details or sketches showing location of each placement of concrete Work. Do not deviate from location of expansion joints or score lines.
- B. Design mix for each concrete mix.
- C. Steel reinforcement shop drawings, including materials, grade, bar schedules, spacing, bent bar diagrams, arrangement and supports.
- D. Submit contraction (crack control) joint, expansion, isolation and construction joint layout to Architect for approval.
- E. Product data on joint filler, sealants, curing compounds and reinforcing.
- F. Project Record Documents
  - 1. Accurately record actual locations of embedded sleeves, utilities and components that are concealed from view.
- G. Submit Certification of experience for color, stain, and aggregate finishers.

#### 1.04 REGULATORY REQUIREMENTS

- A. Pedestrian walks, plazas and paving shall comply with CBC Chapter 11B. Portland Cement concrete paving shall be stable, firm, and slip resistant and shall comply with CBC Sections 11B-302 and 11B-403.

#### 1.05 QUALITY ASSURANCE

- A. Maintain one copy of all records on site.
- B. Acquire cement and aggregate from same source for all Work.
- C. Conform to ACI 318-14 Section 26.5.5, California Building Code, when placing concrete during hot weather.
- D. Conform to ACI 318-14 Section 26.5.4, California Building Code, when placing concrete during cold weather. No placement of concrete permitted below 50 degrees Fahrenheit.
- E. Concrete Stain and Concrete Color Installer Qualifications: Minimum 5 years experience with installing stain and color products specified, certified and approved by the manufacturer.
- F. Exposed aggregate finish installer Qualifications: Minimum 5 years experience with installing aggregate products specified.
- G. Mock-up
  - 1. Install minimum 5 feet by 5 feet mock-up of concrete sidewalk for each surface treatment specified.
  - 2. Install mock-up one month prior to installation.
  - 3. Locate as approved by the Architect.
  - 4. Use identical forming system, sub-grade type, reinforcing, expansion joints, score joints, finishing and edge trim as specified for installation.
  - 5. Architect approval required.
  - 6. Mock-up may not be used in final installation.
  - 7. Remove mock-up materials from site and dispose legally.
- H. Independent Testing Laboratory (Employed by OWNER), is responsible for observing and evaluating the following at batch plant prior to start of work and at other times as requested by the Architect or the Inspector of Record (IOR).
  - 1. Condition of batching equipment
  - 2. Conformance with design mix proportions
  - 3. Storage of materials
  - 4. Mixing equipment
  - 5. Mixing and transporting equipment
  - 6. Other testing to verify compliance if requested by the Architect or IOR.
  - 7. Pre-Construction meeting with the Independent Testing Lab, IOR, General Contractor and Batch Plant Supervisor
  - 8. Condition of concrete transport trucks/Inspection

## 1.06 EXTENDED WARRANTY

- A. Manufacturer shall warrant prefabricated detectable warning texture products against failure in materials or workmanship for at least the specified warranty periods. Upon written notice from Owner manufacturer shall promptly, without cost, and with least practicable inconvenience to Owner correct such defects.
  - 1. Failures include, but are not limited to, significant degradation in color fastness, conformation, sound-on-cane acoustic quality, resilience, and attachment will not degrade significantly.
    - a. Significant degradation means that product loses 10 percent or more of its approved design characteristics, as determined by the authority having jurisdiction.
  - 2. Minimum Warranty Period: 5 years from date of Certified Completion.

## PART 2 - PRODUCTS

### 2.01 CONCRETE MATERIALS

- A. Cement: ASTM C150 - Type II - Moderate, Portland Cement type, from one manufacturing plant only. [Color for exposed matrix: White cement for exposed aggregate finishes and colored concrete per Section 03 35 00].
- B. Aggregates: ASTM C33, single source for all materials. Maximum size aggregate: 1 inch.
- C. Non-Shrink Grout: ASTM C1107, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 4,000 psi in 24 hours and 7,500 psi in 7 days unless otherwise indicated on Drawings; of consistency suitable for application and a 30 minute working time.
- D. Crushed Aggregate Base: As specified in Section 32 12 16. Crushed rock and rock dust conforming to requirements of Section 200-1.2, SSPWC, with 3/8 inch sieve requirement waived, or Class 2 aggregate base as defined in Section 26, CSS.
- E. Integral Color Concrete with Sealer: ASTM C979, manufactured by Davis Colors, Inc, Los Angeles, CA, L.M. Scofield CHROMIX, minimum of three (3) colors, or equal in accordance with Division 01, General Requirements. Colors: As selected by Architect.
- F. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

### 2.02 ACCESSORIES

- A. Expansion Joints:
  - 1. Expansion Joint Filler - ASTM D1751: Closed cell, 1/2 inch thick; DECK-O-FOAM by W. R. Meadows, Dayton Superior or equal.

2. Joint Devices: Integral extruded polystyrene plastic; 1/2 inch max. thick, with removable top strip exposing sealant trough; Snap Cap Expansion Joint Cap by W. R. Meadows or equal.
  3. Sealant: Polyurethane two-component type, self-leveling, for level surface application, UREXPAN NR-200 or DYNATRED for sloped surfaces, manufactured by Pecora Corp., Harleysville PA, or equal. Color shall be selected by Architect from manufacturer's standard list of colors.
  4. Primer: As recommended by sealant manufacturer.
  5. Joint Backing: ASTM C1330, Cylindrical, Type C, closed cell, polyethylene backer rod; oversized 30 to 50 percent larger than joint width. Green Rod by Nomaco Inc. or equal.
- B. Highway Fiber Expansion Joint: 1/2 inch max. thick; FIBER EXPANSION JOINT by American Highway Technology, Kankakee, IL, or equal.
- C. Slip Resistant Finish: Dry shake type White aluminum oxide abrasive grains, hardness No. 9 on Mohr's scale; Emery Non-slip, manufactured by Dayton Superior, Kansas City, KS, Emery Aggregate manufactured by Oregon Emery Co., Halsey OR, or equal as approved in accordance with Division 01, General Requirements for Substitutions.
- D. Detectable Warning Texture: Division of the State Architect (DSA/Access Compliance) approved products shall be used, compliance with CBC Sections 11B-705 and the California Accessibility Reference Manual.
1. Truncated Domes: provide raised Detectable Warnings with diameter of 0.90" min. to 0.92" max. at base tapering to 0.45" min. to 0.47" max. at top, height of 0.20" and base-to-to base spacing of 0.65" min. measured between the most adjacent domes on a square grid (in-line pattern).
    - a. Truncated Dome: shall contrast visually with adjoining surfaces, light-on-dark or dark-on-light per section 11B-705.1.1.3. Material used to provide contrast shall be integral part of walking surface. Warning surface shall differ from adjoining surface in resiliency or sound to cane contact.
  2. Detectable warning surface tiles: Refer to Section 32 17 26.

## 2.03 CONCRETE MIX

- A. Mix and deliver concrete in accordance with Section 1905A, California Building Code. Deliver concrete in transit mixers only. Mix concrete for 10 minutes minimum at a peripheral drum speed of approximately 200 feet per minute. Mix at jobsite minimum 3 minutes. Discharge loads in less than 1-1/2 hours or under 300 revolutions of the drum, whichever comes first, after water is first added.
1. Design Mix:
    - a. Conform to ACI 318-14 Section 26.4.2 for Proportioning on the basis of field experience or trial mixtures method.
    - b. Conform to ACI 318-14 Section 26.4.2 for Selection of concrete proportions method. Selection of concrete proportions and ingredients for design mix by a DSA-approved Testing Laboratory and certified by a registered civil engineer licensed in California.
  2. Do not exceed 0.50 water-cement ratio by weight for slabs and for other concrete.

3. Quantities of Materials: Weighmaster's records not required for sitework concrete.
  4. Required Strength: Minimum 3,000 psi for sitework concrete.
- B. Fly ash shall be used at 15% maximum replacement of the Portland cement at a 1:1 replacement ratio by weight. Fly Ash shall meet the requirements of ASTM C 618 with the exception that the Loss on Ignition shall not exceed 1.0 percent. Only Class F material is permitted.
- C. Solar Reflectivity Index (SRI) of Concrete: provide concrete mix that yields a minimum SRI of 35 with Solar Reflectance value of 0.35 and emittance of 0.9.
- D. Slurry Concrete:
1. Slump: Between 4 inches and 6 inches.
  2. Aggregate: 40 percent sand by weight, 60 percent pea gravel, minimum 1/4 inch, maximum 5/8 inch.
  3. Portland Cement: ASTM C150, 2-sack mix (2 sacks of cement per cubic yard).
  4. Sufficient water shall be added to produce a fluid, workable mix that will flow and can be pumped without segregation of aggregate. Material shall be mechanically mixed until the cement and water are thoroughly dispersed.

## 2.04 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615; deformed billet steel bars, in grades as follows, and conforming to CBC-19, Section 1903A.
1. For No. 4 and larger bars, use 60 ksi yield grade.
  2. For ties and stirrups, and No. 3 and smaller bars, use 40 ksi yield grade.
  3. For welded bars, use ASTM A706 60 ksi yield grade.
- B. Welded Wire Reinforcement: Plain type, ASTM A185; in flat sheets; uncoated finish, 6 x 6 - W4.0 x W4.0 unless otherwise note on drawings.
- C. Tie Wire: Annealed steel, minimum 16 gage size.
- D. Dowels: ASTM A615; 60 ksi yield grade, plain steel, uncoated finish.
- E. Secondary Reinforcement (plastic shrinkage control) Fibrous Reinforcement: Fibrillated, polypropylene fibers for concrete slabs with length of 3/4", Grace Fibers by W.R. Grace, or polypropylene monofilament fibers of 3/4" length Grace Microfibers by the W.R. Grace, or equal. Meeting requirements of ASTM C1116, Type III.
1. Dosage: 1.0 lbs per cubic yard of concrete for 3/4" long fibers.

## 2.05 FORMS

- A. Conform to ACI 318-14 Chapter 26.
- B. Plywood Forms: APA - Medium density overlay, Group 1, Exterior, PS-1, for exposed surfaces. APA Plyform B-B, Class 1, Exterior, PS-1 for unexposed surfaces.
1. Use flexible or curved forms for curves with a radius 100 feet or less.

- C. Lumber: Douglas Fir species, construction grade, Surfaced Lumber, with grade stamp clearly visible for smooth and straight exposed surface.
- D. Form Release Agent; commercially formulated form-release agent that will not bond with, stain or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

## 2.06 CURING MATERIALS

- A. Polyethylene Film ASTM C171; 10 mil thick, clear, manufactured from virgin resin with no scrap or additives, manufactured by Burke-Edoco, Long Beach, CA, or equal as approved in accordance with Division 01, General Requirements for Substitutions.
- B. Water: Potable and not detrimental to concrete.

## 2.07 VEGETATION CONTROL

- A. Under paving, sidewalks, curbs and gutters:
  - 1. Product:
    - a. OUST XP by Dupont Co.
    - b. Monobar-Chlorate by various manufacturers.
    - c. Or approved equal.
- B. Under paving, sidewalks, curbs and gutters within 5' of landscape areas:
  - 1. Product:
    - a. Treflan TR-10 by Dow
    - b. Or approved equal.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify site conditions.
- B. Verify requirements for concrete cover over reinforcement.
- C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely and will not cause hardship in placing concrete.

### 3.02 PREPARATION

- A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
- B. In locations where new concrete is doweled to existing Work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

- C. Ensure sub-base or base materials have been compacted or otherwise treated.
  - 1. Sub-base and base preparation per Section 31 23 16 Excavation and Section 31 23 23 for Backfilling.

### 3.03 PLACING CONCRETE (GENERAL)

- A. Convey and deposit concrete in accordance with ACI 318-14 Chapter 26. Remove loose dirt from excavations.
- B. Notify Job Inspector minimum 24 hours prior to commencement of operations.
- C. Ensure reinforcement, inserts, embedded parts, formed joint fillers, joint devices and accessories are not disturbed during concrete placement.
- D. Install joint fillers, primer and sealant in accordance with manufacturer's instructions.
- E. Place concrete continuously between predetermined expansion joints.
  - 1. Install expansion joints at vertical concrete walls at 24 feet on center unless noted otherwise on drawings.
- F. Do not interrupt successive placement; do not permit cold joints to occur. Avoid segregation of materials. Perform tamping and vibrating so as to produce a dense, smooth application free of rock pockets and voids. Do not use vibrators to move concrete horizontally.
- G. Do not allow concrete to fall free from any height which will cause materials to segregate. Maximum height of free fall permitted in any case: 5 feet.
- H. Defective Installation: Repair and clean at Contractor's expense all concrete damaged or discolored during construction. Where concrete requires repair before acceptance, the repair shall be made by removing and replacing entire section between joints and not by refinishing the damaged portion.
- I. Proper curing of concrete surfaces is the responsibility of the Contractor. Concrete failing to meet specified strength shall be removed and replaced.

### 3.04 ON-SITE CONCRETE SIDEWALKS, PEDESTRIAN PAVED AREAS AND RAMPS

- A. Forms, Wood: Free from warp, with smooth and straight upper edges, surfaced one side, minimum thickness 1-1/2 inches adequate to resist springing or deflection from placing concrete.
- B. Forms, Metal: Gauge thickness sufficient to provide rigidity and strength equivalent to wood.
- C. Reinforcing Steel: #4 bars, place bars at 18 inches on center each way at mid-depth for fire lanes.

- D. Concrete Placement: Dampen subgrade to retain moisture in concrete mix. Tamp and spade to consolidate concrete for entire length of pour. Strike off upper surface to specified grades.
- E. Isolation Joints: Locate at slabs abutting vertical concrete surfaces and as patterned on drawings. Install vertically, full depth of concrete with preformed joint filler recessed for plastic cap at 1/2 inch depth at top for sealant application.
  - 1. Doweled Isolation Joints at Heavy Vehicle Driveways and Parking: At abutting building foundations; provide 1/2-inch diameter smooth steel dowels 14 inches long, one end of dowel lubricated and set in capped sleeve to allow for longitudinal movement, spaced at 24 inches on center maximum, 6 inches from edges.
  - 2. Monolithic Curb and Gutter: No expansion joints required between gutter and curb face.
- F. Expansion Joints: Locate maximum 24 feet centers and as patterned on drawings. Install vertically full depth of concrete, install preformed joint filler recessed for plastic cap at 1/2" depth at top for sealant application.
  - 1. Monolithic Curb and Gutter: No expansion joint required between gutter and curb face.
- G. Contraction/Crack Control Joints: At 8 feet each way at concrete paved areas, and 5 feet at sidewalks, tool joint with 1/2 inch radius, depth 1/4 the thickness of slab but not less than 1 inch deep. Refer to drawings for required design patterns.
- H. Curb Ramps: Provide patterns as indicated in drawings. Detectable Warnings at Curb Ramps per CBC 11B-705.1.1 and 11B-705.1.2.2
  - 1. Detectable Warnings (Truncated Domes) required at all Curb Ramps.
    - a. Plastics/Composites: Cast in place plastic tiles per manufacturer's instructions and in accordance with CBC.
      - 1) Specified in Section 32 17 26 Tactile/Detectable Warning Surface Tile.
- I. Finish:
  - 1. Portland cement paving shall be stable, firm, and slip resistant and shall comply with CBC Sections 11B-302 and 11B-403.
  - 2. Screed concrete to required grade, float to a smooth, flat, uniform surface. Edge all headers to 1/2 inch radius. Edge expansion joints to 1/4 inch radius. Steel trowel to hard surface.
  - 3. Medium Broom Finish: After final troweling, apply a medium broom finish transverse to centerline or direction of traffic.
  - 4. Heavy Broom Finish at Ramps: After final troweling, apply a heavy broom finish transverse to centerline or direction of traffic.
  - 5. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
  - 6. Surface Cross slopes: surface cross slopes shall not exceed one unit vertical in 50 units horizontal (2-percent).
- J. Curing: Cure surfaces utilizing one of the following methods:
  - 1. Spraying: Spray water over slab areas and maintain wet for 7 days, use burlap mats.



2. Spread polyethylene film over slab areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for 7 days.
  3. Apply liquid curing compound at rate of 200 sf per gallon, using power sprayer equipped with agitator. Do not apply liquid curing compound to surfaces scheduled to receive paving units of any kind.
- K. Remove expansion joint plastic caps. Prime both sides of joint and apply self-leveling sealant per Section 07 92 00. Provide smooth concave surface.
- 3.05 LIGHT STANDARD BASES, FENCE POST BASES, FLAGPOLE BASES, RAILING FOOTINGS, MISCELLANEOUS SURFACES, UTILITY PADS, AND SIMILAR SITE STRUCTURES.
- A. Forms: Suitable material and type, size, shape, quality and strength to ensure construction as designed, true to line and sufficiently rigid to resist deflection during placing of concrete. Clean forms of all dirt, mortar and foreign matter before use.
- B. Reinforcement: Place accurately and hold in position, using metal chairs, spacers, metal hangers, supporting wires and other devices of sufficient strength to resist crushing under full load. Clean reinforcing steel of mortar, oil, dirt, loose mill scale loose or thick rust and coatings.
- C. Coordinate installation of conduits, cast in place items and other inserts.
- D. Finish: Grind or sack as required as determined by the Architect to produce a smooth, straight, plumb and acceptable finish without burrs or form marks. For horizontal surfaces: provide float finish.
- E. Curing: Cure surfaces utilizing one of the following methods:
1. Spraying: Spray water over slab areas and maintain wet for 7 days.
  2. Spread polyethylene film over slab areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for 7 days.
  3. Apply liquid curing compound at rate of 200 square feet per gallon, using power sprayer equipped with agitator. Do not apply liquid curing compound to surfaces scheduled to receive paving units or finish of any kind.
- F. Flagpole bases: refer to Section 10 75 00, Flagpoles for size of footings and cast in place items supplied by that section.
- G. Curing: Cure surfaces utilizing one of the following methods:
1. Spread polyethylene film over areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; protect film from damage and dislodging, maintain in place for 7 days.
  2. Apply liquid curing compound-clear at rate of 200 square feet per gallon, using power sprayer equipped with agitator. Do not apply liquid curing compound to surfaces scheduled to receive masonry units.

### 3.06 FORMED CONCRETE STAIRS AND LANDINGS

- A. Subgrade Preparation: As approved by the Geotechnical Engineer.
- B. Forms: Suitable material and type, size, shape, quality and strength to ensure construction as designed, true to line and sufficiently rigid to resist deflection during placing of concrete. Clean forms of all dirt, mortar and foreign matter before use.
- C. Reinforcement: Place accurately and hold in position, using metal chairs, spacers, metal hangers, supporting wires and other devices of sufficient strength to resist crushing under full load. Clean reinforcing steel of mortar, oil, dirt, loose mill scale, loose or thick rust and coatings.
- D. Install specified metal safety nosings flush to finished surfaces.
- E. Form grooved nosing flush to finished surface, 3" wide. Grooves at 1/4" deep, 1/4" wide and at 3/4" on centers full length of stair at all treads. Apply contrasting color paint at all treads per Section 09 90 00.
- F. Finish: Hard steel trowel at monolithic risers. Steel trowel surfaces treated with Slip Resistant Finish sufficiently to allow particles to extend slightly above finish surface.
  - 1. Slip Resistant Finish: Apply in accordance with manufacturer's instructions on surfaces at a minimum rate of 50 lbs. per 100 square feet.
  - 2. Owner's Option in lieu of Slip Resistant Finish:
    - a. Apply Medium Broom Finish.
- G. Curing: Cure surfaces utilizing one of the following methods:
  - 1. Spraying: Spray water over slab areas and maintain wet for 7 days.
  - 2. Contractor's Option
    - a. Spread polyethylene film over slab areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for 7 days.
    - b. Apply liquid curing compound at rate of 200 square feet per gallon, using power sprayer equipped with agitator.
- H. Install anti-slip tape at existing concrete stairs, all treads.

### 3.07 CURB AND GUTTER, PERIMETER CONCRETE CURBING, MOW STRIPS, AND CONCRETE DRAINAGE STRUCTURES

- A. Subgrade Preparation: Subgrade material, base material and compaction requirements as approved by the Geotechnical Engineer.
- B. Forms: Single face type required, cut to conform exactly with face batter and radius, sufficiently rigid to resist springing or deflection from concrete placement. Clean forms of all loose dirt, mortar or similar materials and apply a light coating of oil or other suitable material prior to concrete placement.
  - 1. Slip Forms: Contractor's option upon approval of the Architect.

- C. Reinforcement: Refer to drawings for size and spacing. Interrupt reinforcement at expansion joints.
- D. Concrete Placement: Dampen subgrade to retain moisture in concrete mix. Tamp and spade to consolidate concrete to entire length of pour. Strike off upper surface to specified grades. Cut drain pipes to conform to curb batter.
- E. Expansion Joints: Locate joint filler at maximum 20 foot centers. Trim off excess filler material flush to finish surface. No sealant application required.
- F. Control Joints: at 8 feet on center, tooled joints, 1/2 inch radius.
- G. Finish: Apply thin layer of mortar of 1 part portland cement to 1-1/2 parts sand to exposed faces. Trowel to a smooth and even finish with a fine hair broom applied parallel with the line of the work. Round all edges to 1/2 inch radius. No Contractor identification permitted.
- H. Curing: Cure surfaces utilizing one of the following methods:
  - 1. Spraying: Spray water over curb and gutter and maintain wet for 7 days.
  - 2. Spread polyethylene film over areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for 7 days.
  - 3. Apply liquid-curing compound at rate of 200 sf per gallon, using power sprayer equipped with agitator.
- I. Running Track: imbed metal metric markers in concrete as laid out and required per Section 32 18 28 Synthetic Running Track Surfacing.

### 3.08 CONCRETE THRUST BLOCKS

- A. Refer to Section 32 84 00 Underground Sprinkler Systems and drawings for locations.
- B. Installed where the irrigation main changes direction as at ells and tees and where the irrigation main terminates. Pressure tests shall not be made for a period of 36 hours following the completion of pouring of the thrust blocks. Concrete thrust blocks for supply mains shall be sized and placed in strict accordance with the pipe manufacturer's specifications and shall be of an adequate size and so placed as to take all thrust created by the maximum internal water pressure.

### 3.09 FINISH AT ALL EXPOSED-SURFACES

- A. Rubbed Finish: Apply the following to smooth-formed finished concrete per ACI 301:
  - 1. Grout-Cleaned Finish (Sack-rubbed finish): Remove fins, rough spots, stains, and hardened mortar by carefully rubbing with a fine abrasive stone to a smooth even surface. Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part Portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces.

### 3.10 FIELD QUALITY CONTROL

- A. Provide free access to Work and cooperate with testing personnel
- B. Measure Solar Reflectivity values of Site concrete and submit reports to Architect. ASTM E1980-11

### 3.11 TOLERANCES

- A. Construction tolerances shall not violate dimensions, grades, slopes required by CBC for accessibility requirements. Adjust work accordingly to comply with requirements.
- B. Comply with tolerances of ACI 117 and as follows (tolerances may not exceed CBC maximum or minimum):
  - 1. Maximum deviation of 1/8 inch in 10 feet.
  - 2. Elevation: 1/4 inch (6 mm).
  - 3. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
  - 4. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/8 inch (3 mm).
  - 5. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch (25 mm).
  - 6. Vertical Alignment of Tie Bars and Dowels: 1/4 inch (6 mm).
  - 7. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch (13 mm).
  - 8. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches (6 mm per 300 mm).
  - 9. Joint Spacing: 3 inches (75 mm).
  - 10. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
  - 11. Joint Width: Plus 1/8 inch (3 mm), no minus.

### 3.12 COLORED CONCRETE ON-SITE SIDEWALKS AND CONCRETE AREAS

- A. Conform to On-Site Concrete Sidewalks and Concrete Areas procedures specified in this Section except where specified otherwise in this paragraph.
- B. Approved Manufacturer: Davis Colors, Inc., Los Angeles, CA, L.M. Scofield Company, Los Angeles, CA, or approved equal as approved in accordance with Division 01, General Requirements for Substitutions.
- C. Materials: Cement coloring dye for exterior concrete sidewalks, ASTM C979; integral, with natural and synthetic pigments and no artificial adulterations or filters. Color as selected by the Architect from manufacturer's standard list.
- D. Weight Required: As recommended by the manufacturer for the color selected, in pounds of dye per sack of gray cement in the total batch. Add pigment by weight only, no visual proportioning permitted.
- E. Rinse mixer drum thoroughly before batching colored concrete.

- F. Add coloring agent directly to mixer at charging or mixing speed of 50 to 100 RPM for 5 to 10 minutes. Constant ratio of coloring agent to cement and materials required.
- G. Curing: Cure colored concrete surfaces strictly in accordance with the coloring material manufacturer's recommendations. Apply matching color sealer in accordance with Davis Data #CS 78-1. Do not apply polyethylene sheeting or intermittent wetting of drying.

### 3.13 ROCK-SALT FINISH FOR ON-SITE SIDEWALKS AND CONCRETE AREAS

- A. Rock-Salt Finish: After initial floating, troweling, or brooming, uniformly spread rock salt over paving surface at the rate of 5lb/100 sq. ft.
  - 1. Embed rock salt into plastic concrete with roller or magnesium float.
  - 2. If polyethylene will not smother other textures previously applied to concrete, cover paving surface with 1-mil thick polyethylene sheet and remove sheet when concrete has hardened and seven-day curing period has elapsed.
  - 3. After seven-day curing period, saturate concrete with water and broom-sweep surface to dissolve remaining rock salt, thereby leaving pits and holes.

### END OF SECTION

## **SECTION 32 17 13**

### **PARKING BUMPERS**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section includes wheel stops.

##### **1.3 ACTION SUBMITTALS**

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

##### **1.4 PROJECT CONDITIONS**

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

#### **PART 2 PRODUCTS**

##### **2.1 PARKING BUMPERS**

- A. Concrete Wheel Stops: Precast, steel-reinforced, air-entrained concrete, 4000-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners, transverse drainage slots on underside, and a minimum of two factory-formed or -drilled vertical holes through wheel stop for anchoring to substrate.
  - 1. Surface Appearance: Free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.
  - 2. Mounting Hardware: At each wheel stop provide two galvanized-steel spikes or dowels, 3/4-inch diameter, 10-inch minimum length.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. General: Install wheel stops according to manufacturer's written instructions unless otherwise indicated.
- B. Install wheel stops in bed of adhesive before anchoring.
- C. Adhesively bond anchors to both wheel stop and pavement.
- D. At asphalt paving, extend upper portion of anchor 4-1/2-inches into wheel stop and a minimum of 5-1/2-inches into pavement.
- E. Recess head of hardware beneath top of wheel stop. Fill recess with sealant per Section 07 92 00 "Joint Sealants".

**END OF SECTION**

**SECTION 32 17 23**  
**PAVEMENT MARKINGS**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section includes painted markings applied to asphalt and concrete pavement.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include technical data and tested physical and performance properties.
- B. Shop Drawings: For playground markings.
  - 1. Indicate playground markings, colors, and dimensions.

**1.4 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of CBC Title 24 for pavement-marking work.

**1.5 [PLAYGROUND MARKINGS]**

- A. Where new playground markings are to be provided, locate and configure as shown in the Drawings.]

**1.6 DELIVERY, STORAGE AND HANDLING**

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by the manufacturer. Protect stored materials from direct sunlight.



## 1.7 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials and 55 deg F for water-based materials, and not exceeding 95 deg F.

## 1.8 REGULATORY REQUIREMENTS

- A. Accessible Parking:
1. Accessible parking spaces serving a particular building or facility shall be located on the shortest accessible route to an entrance complying with CBC Section 11B-208.3.1.
  2. Accessible parking spaces serving more than one accessible entrance shall be dispersed and located on the shortest accessible route to the accessible entrances.
  3. Accessible parking spaces in a parking facility not serving a particular building or facility shall be located on the shortest accessible route to an accessible pedestrian entrance of the parking facility. CSC Section 11B-208.3.1
  4. Minimum number of required accessible parking spaces shall be provided in accordance with CSC Table 11B-208.2 for each parking facility provided on a site.
  5. For every six or fraction of six accessible parking spaces, at least one shall be an accessible van parking space. CSC Section 11B- 208.2.4.
  6. Accessible parking spaces and access aisles shall comply with CSC Section 11B-502 and shall be dimensioned to the centerline of the marked lines as follows:
    - a. Parking spaces and access aisles shall be marked according to CSC Figures 11B-502.2, 11B-502.3, and 11B-502.3.3. Their surfaces shall comply with CSC Section 11B-302 and shall be at the same level, with slopes not steeper than 1:48 in any direction. CSC Section 11 B-502.4
    - b. Parking spaces shall be 9'x18' minimum and van parking spaces shall be 12'x18' minimum with an adjacent access aisle of 5'x18' minimum. Access aisles shall be placed on either side of the standard parking spaces, but only on the passenger side of the van parking spaces. Van parking spaces shall be permitted to be 9'x18' minimum where the access aisle is 8'x18' minimum.
    - c. Access aisles shall be marked by a blue painted borderline around their perimeter. The area within the blue borderlines shall be marked with hatched lines a maximum of 36" on center in a color contrasting with that of the aisle surface, preferably blue or white. Access aisle markings may extend beyond the minimum required length. CSC Section 11B- 502.3.3.
    - d. Access aisles (accessible parking spaces as well - similar application) shall not overlap the vehicular way. CSC Section 11B-502.3.4.
    - e. A vertical clearance of 8'-2" minimum shall be provided for accessible parking spaces, access aisles, and vehicular routes serving them. CSC Section 11B-502.5.
- B. Passenger Drop-off and Loading Zones:
1. At least one passenger loading zone shall be provided in every continuous 100

linear feet of loading zone space, or fraction thereof, complying with CSC Sections 11B-209 and 11B-503 as follows:

- a. Vehicle pull-up spaces shall be 8' x 20' minimum.
- b. Access aisles shall be 5' wide minimum x full length of vehicle pull-up spaces they serve and shall be adjacent and parallel to the vehicle pull-up spaces. They shall be at the same level with each other and with slopes not steeper than 1:48 in any direction. Access aisle shall adjoin an accessible route and shall not overlap the vehicular way.
- c. Access aisles for passenger drop-off and loading zone shall be marked with a painted borderline around their perimeter. The area within the borderlines shall be marked with hatched lines a maximum of 36" on center in a color contrasting with that of the aisle surface. (Blue perimeter lines with blue interior hatch lines are preferred for concrete surfaces and blue perimeter lines with white interior hatch lines are preferred for asphalt surfaces.) CBC Section 11B-503.3.3.
- d. A vertical clearance of 9'-6" minimum shall be provided for vehicle pull-up spaces, access aisles, and a vehicular route serving them connecting a vehicular entrance and a vehicular exit. CBC Section 11B-503.5.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Dunn-Edwards Corporation.
  2. Frazee Paint; Comex Group.
  3. Sherwin-Williams Company (The).
  4. Or Equal.

### **2.2 PAVEMENT-MARKING PAINT**

- A. Pavement-Marking Paint: Alkyd traffic-marking paint.
  1. Color: Refer to drawings.
- B. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952E, Type II, with drying time of less than three minutes.
  1. Color: Refer to drawings.
- C. Pavement-Marking Paint: Latex traffic-marking paint.
  1. Color: Refer to drawings.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.
- B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

### **3.2 PAVEMENT MARKING**

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with the District Project Manager and District Construction Manager.
- B. Allow paving to age for a minimum of 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
  - 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.

### **3.3 PROTECTING AND CLEANING**

- A. Protect pavement markings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

**END OF SECTION**

## **SECTION 32 17 26**

### **TACTILE WARNING SURFACING**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Cast-in-place detectable warning tiles.
  - 2. Detectable warning unit pavers.

##### **1.3 ACTION SUBMITTALS**

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

##### **1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For tactile warning surfacing, to include in maintenance manuals.

##### **1.5 QUALITY ASSURANCE**

- A. Surface-applied detectable warning tiles or mats are not permitted.
- B. Tactile Warning Surfacing shall have a coefficient of friction of 0.6 minimum when tested in accordance with ASTM C 1028.

##### **1.6 PROJECT CONDITIONS**

- A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.
- B. Weather Limitations for Adhesive Application:
  - 1. Apply adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when substrate is wet or contains excess moisture.

- C. Weather Limitations for Mortar and Grout:
  - 1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
  - 2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and windbreaks, and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.
    - a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F, set unit pavers within 1 minute of spreading setting-bed mortar.

## **1.7 WARRANTY**

- A. Manufacturer's certification that indicates compliance with the architectural access standards as published in the current edition of the CBC.
- B. Special Warranty: Manufacturer agrees to repair or replace components of tactile warning surfaces that fail in materials or workmanship within specified warranty period.
  - 1. Failures include:
    - a. Deterioration of finishes beyond normal weathering and wear.
    - b. Deterioration of durability criteria as listed below.
    - c. Separation or delamination of materials and components.
  - 2. Warranty Period: Provide a minimum five year warranty from date of Substantial Completion of durability criteria, including shape, color fastness, confirmation, sound-on-cane acoustic quality, resilience and attachment, per DSA Bulletin 10/31/02 revised 4/9/08.

## **PART 2 PRODUCTS**

### **2.1 TACTILE WARNING SURFACING, GENERAL**

- A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities, and the CBC for tactile warning surfaces.
  - 1. For tactile warning surfaces composed of multiple units, provide units that when installed provide consistent side-to-side and end-to-end dome spacing that complies with requirements.
- B. Source Limitations: Obtain each type of tactile warning surfacing, joint material, setting material, anchor, and fasteners from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

## **2.2 DETECTABLE WARNING TILES**

- A. Cast-in-Place Detectable Warning Tiles: Accessible truncated-dome detectable warning tiles configured for setting flush in new concrete walkway surfaces, with slip-resistant surface treatment on domes and field of tile.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Armorcast Products Company.
    - b. Detectable Warning Systems, Inc.
    - c. StrongGo Industries, LLC.
    - d. Or Equal.
  - 2. Material: Cast-fiber-reinforced polymer concrete tile.
  - 3. Color: Safety yellow.
    - a. Color No. 33538 per Federal Standard 595B.
    - b. Color must be integral throughout the tile and not surface applied.
  - 4. Sizes:
    - a. Rectangular panel, as shown on plans.
  - 5. Dome Spacing and Configuration:
    - a. 2.35-inch center-to-center spacing in all directions and across adjacent tiles.
    - b. Round truncated dome configuration, 0.9" (22 mm) diameter at base and 0.45" (11 mm) diameter at top.
    - c. Truncated dome height: 0.2" (5 mm).
    - d. Layout: Square layout within the tile and square to the direction of travel.
  - 6. Mounting:
    - a. Permanently embedded detectable warning tile wet-set into freshly poured concrete.

## **2.3 DETECTABLE WARNING UNIT PAVERS**

- A. Detectable Warning Concrete Unit Pavers: Solid paving units, made from normal-weight concrete with a compressive strength of not less than 5000 psi, water absorption of not more than 5 percent according to ASTM C 140, and no breakage and not more than 1 percent mass loss when tested for freeze-thaw resistance according to ASTM C 67, with accessible detectable warning truncated domes on exposed surface of units.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hanover Architectural Products.
    - b. Stepstone, Inc.
    - c. Tile-Tech Pavers.
    - d. Or Equal.
  - 2. Sizes:
    - a. Thickness: 2 inches at field of tile.
    - b. Face Size: Nominal as shown on plans.
  - 3. Dome Spacing and Configuration:
    - a. 2.35-inch center-to-center spacing in all directions and across adjacent tiles.
    - b. Round truncated dome configuration, 0.9" (22 mm) diameter at base and 0.45" (11 mm) diameter at top.

- c. Truncated dome height: 0.2" (5 mm).
  - d. Layout: Square layout within the tile and square to the direction of travel.
- 4. Color: Safety Yellow:
  - a. Color No. 33538 per Federal Standard 595B.
  - b. Color must be integral throughout the paver and not surface applied.
- B. Mortar Setting Bed:
  - 1. Portland Cement: ASTM C 150/C 150M, Type I or Type II.
  - 2. Sand: ASTM C 33/C 33M.
  - 3. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed Portland cement and aggregate mortar bed, and not containing a retarder.
  - 4. Thinset Mortar: Latex-modified Portland cement mortar complying with ANSI A118.4.
  - 5. Water: Potable.

## **2.4 ACCESSORIES**

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of tactile warning surfaces, noncorrosive and compatible with each material joined, and complying with the following:
  - 1. Furnish Type 304 stainless-steel fasteners for exterior use.
  - 2. Fastener Heads: For nonstructural connections, use only flush, oval countersunk screws and bolts with tamper-resistant heads, colored to match tile.
- B. Adhesive: As recommended by manufacturer for adhering tactile warning surfacing unit to pavement.
- C. Sealant: As recommended by manufacturer for sealing perimeter of tactile warning surfacing unit.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that pavement is in suitable condition to begin installation according to manufacturer's written instructions. Verify that installation of tactile warning surfacing will comply with accessibility requirements upon completion.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION OF TACTILE WARNING SURFACING**

- A. General: Prepare substrate and install tactile warning surfacing according to manufacturer's written instructions unless otherwise indicated.

- B. Place tactile warning surfacing units in dimensions and orientation indicated.
- C. Provide expansion joints around perimeter of precast concrete tiles and at 8' on center maximum in both directions.
- D. Installation must comply with the architectural access standards as published in the current edition of the CBC.

### **3.3 INSTALLATION OF DETECTABLE WARNING TILES**

- A. Cast-in-Place Detectable Warning Tiles:
  - 1. Concrete Paving Installation: Comply with installation requirements in Section 32 13 13 "Concrete Paving." Mix, place, and finish concrete to conditions complying with detectable warning tile manufacturer's written requirements for satisfactory embedment of tile.
  - 2. Set each detectable warning tile accurately and firmly in place and completely seat tile back and embedments in wet concrete by tamping or vibrating. If necessary, temporarily apply weight to tiles to ensure full contact with concrete.
  - 3. Set surface of tile flush with surrounding concrete and adjacent tiles, with variations between tiles and between concrete and tiles not exceeding plus or minus 1/8-inch from flush.
  - 4. Protect exposed surfaces of installed tiles from contact with wet concrete. Complete finishing of concrete paving surrounding tiles. Remove concrete from tile surfaces.
  - 5. Clean tiles using methods recommended in writing by manufacturer.

### **3.4 INSTALLATION OF DETECTABLE WARNING UNIT PAVERS**

- A. Unit Paver Installation, General:
  - 1. Setting-Bed and Unit Paver Installation: Comply with installation requirements in Section 32 14 00 "Unit Paving."
  - 2. Use full units without cutting.
  - 3. Tolerances: Do not exceed indicated slope in direction of travel, or 2% cross-slope for finished surface of paving.
- B. Mortar Setting-Bed Applications:
  - 1. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.
  - 2. Apply mortar-bed bond coat over surface of concrete subbase about 15 minutes before placing mortar bed. Limit area of bond coat to avoid its drying out before placing setting bed. Do not exceed 1/16-inch thickness for bond coat.
  - 3. Apply mortar bed over bond coat; spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.
  - 4. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Before placing pavers, cut back, bevel edge, and remove and discard setting-bed material that has reached initial set.
  - 5. Place pavers before initial set of cement occurs. Immediately before placing



- pavers on mortar bed, apply uniform 1/16-inch-thick bond coat to mortar bed or to back of each paver with a flat trowel.
6. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of realigning finished surfaces or adjusting joints.
  7. Spaced Joint Widths: Provide 3/8-inch nominal joint width with variations not exceeding plus or minus 1/16-inch.
  8. Grouted Joints: Grout paver joints complying with ANSI A108.10. Grout joints as soon as possible after initial set of setting bed.
    - a. Force grout into joints, taking care not to smear grout on adjoining surfaces.
    - b. Tool exposed joints slightly concave when thumbprint hard.
    - c. Cure grout by maintaining in a damp condition for seven days unless otherwise recommended by grout or liquid-latex manufacturer.
    - d. Grout color must match adjacent tactile warning surfacing color. Safety yellow, Color No. 33538 per Federal Standard 595B.
  9. Remove excess grout from exposed paver surfaces; wash and scrub clean.
  10. Protect installation from traffic until grout has set.

### **3.5 CLEANING AND PROTECTION**

- A. Remove and replace tactile warning surfacing that is broken or damaged or does not comply with requirements in this Section. Remove in complete sections from joint to joint. Replace using tactile warning surfacing installation methods acceptable to District Construction Manager.
- B. Protect tactile warning surfacing from damage and maintain free of stains, discoloration, dirt, and other foreign material.

### **END OF SECTION**

## **SECTION 32 31 13**

### **CHAIN LINK FENCES AND GATES**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Chain-link fences.
  - 2. Swing gates.
- B. Related Requirements:
  - 1. Section 03 30 00 "Cast-in-Place Concrete" for concrete.
  - 2. Section 08 71 00 "Door Hardware" for electrified gate hardware.

##### **1.3 COORDINATION**

- A. Coordinate electrified gate hardware to comply with single source manufacturer requirement specified in section 08 71 00 "Door Hardware".

##### **1.4 PRE-INSTALLATION MEETINGS**

- A. Pre-installation Conference: Conduct conference at Project site.
  - 1. Review required testing, inspecting and certifying procedures.

##### **1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
    - a. Fence and gate posts, rails, and fittings.
    - b. Chain-link fabric, reinforcements, and attachments.
    - c. Accessories: Panic Hardware.
    - d. Gates and hardware.
- B. Shop Drawings: For each type of fence and gate assembly.
  - 1. Include plans, elevations, sections, details, and attachments to other work. Show

- locations of gates, posts, rails, and tension wires, and details of gate swing, or other operation, hardware, and accessories.
- 2. Indicate materials, dimensions, sizes, weights, and finishes of components.
- 3. Include accessories, hardware, gate operation, and operational clearances.
- C. Qualification Data: For testing agency.
- D. Product Test Reports: For framework strength according to ASTM F 1043, for tests performed by manufacturer and witnessed by a qualified testing agency.
- E. Sample Warranty: For special warranty.

## **1.6 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: For testing fence grounding, member company of NETA or an NRTL.
  - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
- B. Emergency Access Requirements: Comply with requirements of the Division of the State Architect (DSA) for gates serving as a required means of access.
- C. Post and rail piping shall not be installed until the Project Inspector verifies that the material meets the specified weight per lineal foot for each pipe size to be used.
- D. Post footing excavations shall be approved by the Project Inspector prior to setting any posts.
- E. Gates that are part of the accessible route shall meet all the requirements of an accessible door in compliance with CBC Section 11B-404.
- F. The levers of lever actuated latches or locks for accessible gates shall be curved with a return to within ½ inch of the gate surface to prevent catching on clothing or persons. California Reference Standard Code, T-24 Part 12, Section 12-10-202, Item (f).
- G. Swing gate surfaces within 10 inches of the finished floor or ground shall be a smooth surface on the push side extending the full width of the gate. Parts creating horizontal or vertical joints in the surface shall be within 1/16 inch of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped. CBC Section 11B-404.2.10.

## **1.7 WARRANTY**

- A. Special Warranty: Manufacturer and Installer agree to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
  - 1. Failures include:
    - a. Deterioration of metals, metal finishes, and other materials beyond normal

- weathering.
- b. Fabric bowing, sagging, breakage or similar defects.
- c. Fence framework failure.
- d. Faulty operation of gate hardware.
- 2. Warranty Period: Five years from date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.

### **2.2 CHAIN-LINK FENCE FABRIC**

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:
  - 1. Fabric Height: 10 feet.
  - 2. Steel Wire for Fabric: 9-gauge.
    - a. Mesh Size:
      - 1) Standard Fence Fabric: 2 inches.
      - 2) Where indicated on Drawings: 1 inch.
    - b. Aluminum-Coated Fabric: ASTM A 491, minimum 0.40 oz./sq.ft. with coating applied after weaving.
  - 3. Selvage: Knuckled at both selvages.

### **2.3 FENCE FRAMEWORK**

- A. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; gate; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:
  - 1. Fence Height: As indicated on Drawings.
  - 2. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40.
    - a. Thread protectors shall not be used as couplings under any circumstances.
    - b. All pipe used in chain link fencing shall be stamped by the manufacturer, either with indelible ink or incused, indicating the pipe wall thickness, inside diameter, ASTM standard to which it conforms, and the manufacturer's name.
    - c. Line Post: 2.375 inches in diameter, unless otherwise indicated on the Drawings.
    - d. End, Corner, Gate, and Pull Posts: 2.875 inches in diameter, unless indicated otherwise on the Drawings.
    - e. Flanging of end (terminal posts):
      - 1) Terminal posts and gate posts shall only be flanged to assist in relocatable building moves.
      - 2) A larger pipe shall be dropped over a smaller post only when a short run

- of existing fencing is terminated and when digging a new hole to install a bigger terminal post is impractical. This shall be used as a temporary repair, not as a permanent repair or installation.
- 3) If it is necessary to create a removable section of fence (to assist in relocatable building moves), a smaller pipe shall be sleeved into a smaller line post.
  - 4) Sleeves sizes shall conform to ASTM A53, Schedule 40.
    - a) For a 2-inch Interior Diameter (ID) sleeve, insert 1-1/2-inch ID pipe.
    - b) For a 2-1/2-inch ID sleeve, insert 2-inch ID pipe.
    - c) For a 3-inch ID sleeve, insert a 2-1/2-inch ID pipe.
  3. Horizontal Framework Members: Comply with ASTM F 1043.
    - a. Top Rails: Provide at all chain-link fencing. Fabricate top rail from lengths 21 feet or longer, with wedged-end or fabricated for expansion-type coupling, forming a continuous rail along top of chain-link fabric. Provide expansion couplings 6 inches long at each joint in top rails.
    - b. Intermediate Rails: Provide at tennis court and multi-purpose court wall fencing and where indicated. Match top rail for finish and size.
    - c. Bottom Rails: Provide at athletic field, tennis and handball court, and multi-purpose court wall fencing and where indicated. Also provide where decomposed granite, grass, planters and synthetic fields abut any fence line. Match top rail for finish and size.
  4. Top Rails, Intermediate Rails, Bottom Rails and Brace Rails: 1.66 inches in diameter, unless indicated otherwise on the Drawings.
  5. Post Brace Rails: Provide brace rail with truss rod assembly for each gate, end, and pull post. Provide two brace rails extending in opposing directions, each with truss rod assembly, for each corner post and for pull posts. Provide rail ends and clamps for attaching rails to posts.
  6. Metallic Coating for Steel Framework:
    - a. Type A: Not less than minimum 2.0-oz./sq. ft. average zinc coating according to ASTM A 123/A 123M; internal and external; hot-dipped after fabrication.
  7. Schedule of Pipe Sizes: See following Table 1.

B. TABLE 1

C. ASTM A53 Threaded and Coupled Pipe

D. Black and Galvanized 1/2" to 6"

Nominal Size	Outside Diameter		Wall Thickness			Weight		
Inches	Inches	mm	Inch	mm	No	lb/ft	Kg/m	Kg/ft
1/2"	0.084	21.3	0.109	2.77	40 (STD)	0.85	1.26	0.39
			0.147	3.73	80 (XS)	1.09	1.62	0.49
3/4"	1.050	26.7	0.113	2.87	40 (STD)	1.13	1.68	0.51
			0.154	3.91	80 (XS)	1.48	2.20	0.67
1"	1.315	33.4	0.133	3.38	40 (STD)	1.68	2.50	0.76
			0.179	4.55	80 (XS)	2.18	3.24	0.99
1 1/4"	1.660	42.2	0.140	3.56	40 (STD)	2.288	3.39	1.04
			0.191	4.85	80 (XS)	3.02	4.49	1.37
1 1/2"	1.900	48.3	0.145	3.68	40 (STD)	2.73	4.06	1.24
			0.200	5.08	80 (XS)	3.66	5.45	1.66
2"	2.375	60.3	0.154	3.91	40 (STD)	3.68	5.42	1.67
			0.208	5.34	80 (XS)	5.07	7.55	2.30
2 1/2"	2.875	73.0	0.203	5.16	40 (STD)	5.82	8.66	2.64
			0.276	7.01	80 (XS)	7.73	11.50	3.51
3"	3.500	88.9	0.216	5.49	40 (STD)	7.62	11.34	3.46
			0.300	7.62	80 (XS)	10.33	15.37	4.69
3 1/2"	4.000	101.6	0.226	5.74	40 (STD)	9.2	13.69	4.18

			0.3 18	8. 08	80 (XS)	12. 63	18. 80	5.7 3
4"	4.500	114.3	0.2 37	6. 02	40 (STD)	10. 89	16. 21	4.9 4
			0.3 37	8. 56	80 (XS)	15. 17	22. 58	6.8 9
6"	6.625	168.3	0.2 80	7. 11	40 (STD)	18. 97	28. 23	8.6 0
			0.3 12	7. 92	80 (XS)	21. 04	31. 31	9.5 4

## 2.4 TENSION WIRE

- A. General: Provide horizontal bottom tension wire at all fence fabric not having a bottom rail.
- B. Metallic-Coated Steel Wire: 0.177-inch-diameter, marcelled tension wire according to ASTM A 817 or ASTM A 824, with the following metallic coating:
  - 1. Type II: Zinc coated (galvanized) by hot-dip process, with a Class 4 minimum coating weight; not less than 1.2 oz./sq. ft. of uncoated wire surface.

## 2.5 SWING GATES

- A. General: Comply with ASTM F 900 for gate posts and single and double swing gate types. See Table 2 for sizes.
  - 1. Gate Leaf Width: As indicated.
- B. Pipe and Tubing:
  - 1. Zinc-Coated Steel: ASTM A 53, ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framework; Schedule 40.
  - 2. Gate Posts: Round hot-dipped galvanized tubular steel with inside dimensions and weight according to Table 2 for the gate leaf widths required.
    - a. All gate posts shall be of sufficient strength so that the total deflection of the gate and the post at the end of the gate leaf shall not exceed the lesser of 2% of the gate leaf width or 4 inches.
    - b. When necessary to meet this requirement due to the total weight of the gate leaf, the next larger size posts required shall be used. Gates shall not be equipped with rollers or casters for support.
  - 3. Gate Frames and Bracing: Round hot-dipped galvanized tubular steel with minimum diameter of 1.900-inch. Provide diagonal cross-bracing, consisting of 3/8-inch diameter adjustable-length truss rods on welded gate frames, where necessary to obtain frame rigidity without sag or twist.
- C. Frame Corner Construction: Welded, with 5/16-inch diameter adjustable truss rods for panels 5 feet wide or wider.

D. TABLE 2

Swing gate member sizes		
Gate opening	Nominal size	lb/ft.
Single leaf to 6 feet	2 1/2"	5.79
Double leaf to 12 feet opening		
Single leaf 6 to 13 feet	3 1/2"	9.11
Double leaf 12 to 26 feet opening		
Single leaf 13 to 18 feet	6"	18.97
Double leaf 26 to 36 feet opening		

E. Hardware:

1. Hinges: Heavy-duty offset, with 180-degree inward swing.
  - a. In addition to bolting, spotweld all hinges to posts.
2. Latch: Permitting operation from both sides of gate.
  - a. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.
  - b. Single latches shall be industrial gravity type gate latch with automatic stop.
  - c. Double latch shall be drop bar 1.315-inch diameter nominal pipe size securely bolted to gate frame and shall engage an iron gate stop. Drop bar shall engage 1.900-inch pipe diameter pipe sleeve set in concrete. Provide drop bar keeper on gate to secure it in lifted position.
  - d. In addition to bolting, spotweld all latches to posts.
3. Padlock and Chain:
  - a. Provide means of padlocking gates in the open position where indicated that gate must be locked in open position during activity hours.
  - b. Chains: Provide each gate with 3-foot length of chain to secure gate to fence with a padlock when open. Install 3/4-inch round eye, cadmium plated harness snap on one end of chain. Secure chain with spotweld.
4. All screws and bolts shall be tamper-proof.
5. Provide center gate stops.
6. For all gates more than 5 feet wide, provide keepers.
7. Hardware for gates that are part of the access or egress system:
  - a. Gates (in Path-of-Travel), hardware, maneuvering clearances, and operation shall comply with applicable portions of CBC accessibility requirements.
  - b. Omit latch and make provisions to receive exit device hardware.
  - c. Provide 16 gage steel plate for mounting of exit device on gate and exit device latch on post. Size plate to protect against unauthorized operation of the exit device from the exterior as shown.
  - d. Mount operating hardware at minimum 30 inches and maximum 44 inches above grade or pavement surface.
8. See section 08 71 00 "Door Hardware".



## **2.6 FITTINGS**

- A. Provide fittings according to ASTM F 626.
- B. Post and Line Caps: Hot-dipped galvanized pressed steel or hot-dipped galvanized cast iron. Provide weathertight closure cap for each post.
  - 1. Provide line post caps with loop to receive top rail.
- C. Rail and Brace Ends: Hot-dipped galvanized pressed steel or hot-dipped galvanized cast iron. Provide rail ends or other means for attaching rails securely to each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
  - 1. Top Rail Sleeves: Hot-dipped galvanized pressed steel or hot-dipped galvanized round-steel tubing not less than 6 inches long.
  - 2. Rail Clamps: Hot-dipped galvanized pressed steel. Provide line and corner boulevard clamps for connecting intermediate and bottom rails to posts.
- E. Tension and Brace Bands: Hot-dip galvanized pressed steel. Provide bands with projecting edges chamfered or eased.
- F. Tension Bars: Hot-dipped galvanized steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading, rod and turnbuckle or other means of adjustment.
- H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
  - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:
    - a. Hot-Dip Galvanized Steel: 0.148-inch-diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.
- I. Finish:
  - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.

## **2.7 CAST-IN-PLACE CONCRETE**

- A. General: Comply with ACI 301 for cast-in-place concrete.
- B. Materials: Portland cement complying with ASTM C 150 Type II, aggregates complying with ASTM C 33, and potable water for ready-mixed concrete complying with ASTM C 94.
  - 1. Concrete Mixes: Normal-weight concrete with not less than 3000-psi compressive strength (28 days), 4-inch slump, and 1-inch maximum size aggregate.

## **2.8 GROUT AND ANCHORING CEMENT**

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

## **2.9 GROUNDING MATERIALS**

- A. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- B. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.
  - 1. Connectors for Below-Grade Use: Exothermic welded type.
  - 2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
  - 1. Do not begin installation before final grading is completed unless otherwise permitted by District Construction Manager.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
- B. Clear fence line of trees, brush, and other obstacles to install fencing. Establish a graded, compacted fence line prior to fencing installation.

### 3.3 CHAIN-LINK FENCE INSTALLATION

- A. Install chain-link fencing according to ASTM F 567 and more stringent requirements specified.
  - 1. Install fencing on established boundary lines inside property line.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
  - 1. If rock is encountered, excavate in accordance with 31 20 00 "Earth Moving."
- C. Post Setting: Set posts in concrete footings at indicated spacing into firm, undisturbed or compacted soil. Using mechanical devices to set line posts per ASTM F 567 is not permitted.
  - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices until concrete is sufficiently cured.
  - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
    - a. Dimensions and Profile: As indicated on Drawings. Install concrete footings at all fence posts.
    - b. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water. Keep exposed concrete moist for at least 7 days after placement, or cured with an approved membrane curing material.
    - c. Concealed Concrete at planting, turf areas, on-grade concrete paving: Place top of concrete 2 inches below grade, or as indicated on Drawings, to allow covering with surface material.
    - d. Posts Set into Sleeves in Concrete: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
    - e. Posts Set into Holes in Concrete: Form or core drill holes to depth indicated on drawings and 3/4-inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
- D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.
- E. Line Posts: Space line posts uniformly as follows:
  - 1. Standard fencing: 10 feet o.c.
  - 2. Tennis and multi-purpose court wall fencing: 10 feet o.c.
  - 3. Handball court fencing: 5 to 6 feet o.c., based on bay size.

4. High Security fencing: 8 feet o.c.
- F. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- G. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
1. Extended along bottom of fence fabric. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- H. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- I. Intermediate Rails: where indicated, install in one piece at post-height center span, spanning between posts, using fittings, special offset fittings, and accessories.
- J. Bottom Rails: Where indicated, install and secure to posts with fittings.
- K. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2-inch bottom clearance between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released. Do not allow fabric to be in contact with finish grade.
- L. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.
- M. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
- N. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

### **3.4 GATE INSTALLATION**

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

### **3.5 GROUNDING AND BONDING**

- A. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- B. Fences Enclosing Electrical Power Distribution Equipment: Ground according to IEEE C2 unless otherwise indicated.
- C. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.
- D. Connections:
  - 1. Make connections with clean, bare metal at points of contact.
  - 2. Make above-grade ground connections with mechanical fasteners.
  - 3. Make below-grade ground connections with exothermic welds.
  - 4. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

### **3.6 FIELD QUALITY CONTROL**

- A. Engage a qualified testing agency to perform tests.
- B. Prepare test reports.

### **3.7 TOLERANCES**

- A. Maximum Offset From True Position: 1-inch.
- B. Maximum Variation From Plumb: 1/4-inch. Vertical post tolerance of 1/4-inch shall be after the fabric has been stretched.
- C. Components shall not infringe adjacent property lines.

### **3.8 ADJUSTING**

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

### **3.9 GALVANIZING REPAIR**

- A. Clean and repair galvanized surfaces damaged by welding or abrasion, cut ends of fabric, and other cut sections with specified galvanizing repair material applied in conformance with manufacturer's printed instructions.

**END OF SECTION**

## **SECTION 32 31 19**

### **DECORATIVE METAL FENCES AND GATES**

#### **PART 1 GENERAL**

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

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Decorative steel fences.
  - 2. Decorative steel swing gates.
- B. Related Requirements:
  - 1. Section 03 30 00 "Cast-in-Place Concrete" for concrete.
  - 2. Section 08 71 00 "Door Hardware" for additional gate hardware.

##### **1.3 COORDINATION**

- A. Coordinate electrified gate hardware to comply with single source manufacturer requirement specified in section 08 71 00 Door Hardware.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
    - a. Fence and gate posts, rails, and fittings.
    - b. Gates and hardware.
    - c. Decorative metal panel
- B. Shop Drawings: For fencing and gates.
  - 1. Include plans, elevations, sections, details, gate locations, details of gate swing, or other operation, hardware, and accessories, post spacing, and mounting and attachment details.

##### **1.5 INFORMATIONAL SUBMITTALS**

- A. Welding Certificates.

## **1.6 QUALITY ASSURANCE**

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Gates that are part of the accessible route shall meet all the requirements of an accessible door in compliance with CBC Section 11B-404.
- D. The levers of lever actuated latches or locks for accessible gates shall be curved with a return to within ½ inch of the gate surface to prevent catching on clothing or persons. California Reference Standard Code, T-24 Part 12, Section 12-10-202, Item (f).
- E. Swing gate surfaces within 10 inches of the finished floor or ground shall be a smooth surface on the push side extending the full width of the gate. Parts creating horizontal or vertical joints in the surface shall be within 1/16 inch of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped. CBC Section 11B-404.2.10.

## **PART 2 PRODUCTS**

### **2.1 DECORATIVE STEEL FENCES**

- A. Decorative Steel Fences: Fences made from steel tubing, bars and shapes, hot-dip galvanized. Paint all exposed surfaces after all welding and galvanization repairs have been completed.
- B. Posts: Square steel HSS as indicated on drawings.
- C. Post Caps
  - 1. Provide caps on all posts to prevent water from entering posts.
  - 2. Shape: Provide flat caps slightly angled to shed water.
  - 3. Attachment: Welded prior to galvanizing posts.
  - 4. Material: Heavy duty galvanized steel.
- D. Infill: Custom design as indicated on Drawings.
  - 1. Manufacturers:
    - a. Parasoleil, Basis of design
    - b. Artisan Panels Inc.
    - c. Revamp Panels
    - d. Or equal
  - 2. Panel Material: Aluminum Sheet
  - 3. Panel Thickness: 3/16-inch thick.
  - 4. Pattern: Polypore, basis of design. Pattern by acceptable manufacturers to be of similar porosity, detail, and design to be selected by Architect.
  - 5. Finish: Manufacturer standard powder coat system.



- 6. Color: Custom to match Dunn Edwards DET 521 Arizona Tree Frog.
- E. Fasteners: Stainless-steel one way carriage bolts and tamperproof nuts.
- F. Fabrication: Assemble fences into sections by welding frames.
  - 1. Weld assembled sections to posts.
- G. Welding:
  - 1. Weld steel angles on all sides with 1/8" fillet welds, 1" length at 12" O.C. maximum.
- H. Finish exposed welds to comply with NOMMA Guideline 1, Finish #3 - partially dressed weld with splatter removed.
- I. Galvanizing: For items other than hardware and infill panel that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
  - 1. Hot-dip galvanize posts, angles, and rails.
  - 2.
- J. Painting: Per 09 91 13 "Exterior Painting". Match Dunn Edwards DET 521 Arizona Tree Frog.

## **2.2 SWING GATES**

- A. Gate Configuration: Refer to drawings.
- B. Gate Frame Height: Refer to drawings.
- C. Gate Opening Width: Refer to drawings.
- D. Galvanized-Steel Frames and Bracing: Fabricate from 2x2x3/16" HSS.
- E. Frame Corner Construction: Welded. All upright and rail intersections shall be joined by welding. All plate and angle intersections shall be joined by welding.
- F. Infill: As indicated on the Drawings.
- G. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf. Provide removable center gate posts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.
  - 1. Refer to Section 08 71 00 "Door Hardware" Specification for detailed hardware requirements.
- H. Hinges: BHMA A156.1, Grade 1, suitable for exterior use.
  - 1. Function: 39 - Full surface, triple weight, weld-on, antifriction ball-bearing.
  - 2. Material: Wrought steel, forged steel, cast steel, or malleable iron; galvanized.
  - 3. Attachment: Fully welded.

- I. Mortise Locks: BHMA A156.13, Grade 1, suitable for exterior use.
  - 1. Function: Per Section 08 71 00 "Door Hardware."
  - 2. Material: Brass or bronze.
  - 3. Levers: Cast, forged, or extruded brass or bronze.
  - 4. Mounting Box: Configuration necessary to enclose locks. Fabricate from 1/8-inch-thick, steel plate; galvanized.
- J. Finish exposed welds to comply with NOMMA Guideline 1, Finish #3 - partially dressed weld with splatter removed.
- K. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
- L. Painting: Per section 09 91 13 "Exterior Painting". Match Dunn Edwards DET 521 Arizona Tree Frog.

## **2.3 STEEL AND IRON**

- A. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Bars (Pickets): Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
- C. Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- D. Bar Grating: NAAMM MBG 531.
  - 1. Bars: Hot-rolled steel strip, ASTM A 1011/A 1011M, Commercial Steel, Type B.
  - 2. Wire Rods: ASTM A 510/A 510M.
- E. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 50, with G90.
- F. Castings: Either gray or malleable iron unless otherwise indicated.
  - 1. Gray Iron: ASTM A 48/A 48M, Class 30.
  - 2. Malleable Iron: ASTM A 47/A 47M.

## **2.4 MISCELLANEOUS MATERIALS**

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 03 30 00 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 4-inch slump, and 1-inch maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C 387/C 387M mixed with potable water according to manufacturer's written instructions.
- C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout

complying with ASTM C 1107/C 1107M and specifically recommended by manufacturer for exterior applications.

- D. Galvanizing Repair: Repair compound meeting or exceeding ASTM A 780.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
- B. Do not begin installation before final grading is completed unless otherwise permitted by District Construction Manager.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.
  - 1. Construction layout and field engineering are specified in Section 01 73 00 "Execution."

### **3.3 DECORATIVE FENCE INSTALLATION**

- A. Install fences by setting posts as indicated and field welding the rails of the assemblies to posts.
- B. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.
- C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
  - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
  - 2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
    - a. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.
    - b. Concealed Concrete: Top 2 inches to allow covering with surface material. Slope top surface of concrete to drain water away from post.
  - 3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.

4. Space posts uniformly at indicated spacing.

### **3.4 GATE INSTALLATION**

- A. Install gates level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

### **3.5 GALVANIZING REPAIR**

- A. Repair damaged galvanizing and coat field welded areas with 2 coats of galvanizing repair compound.

### **3.6 ADJUSTING**

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

**END OF SECTION**

**IRRIGATION  
SECTION 32 80 00**

**DIVISION 00 AND 01 ARE A PART OF THIS SECTION**

**Part 1 - General**

- 1.01 Description of Work
  - A. All labor, materials, tools and the transportation and performance of all the work required as indicated in the Drawings and Specifications and reasonably incidental to:
    - 1. Connection to water supply (meter and backflow device installed by others).
    - 2. Irrigation mains, laterals and couplings.
    - 3. Automatic controllers and wiring.
    - 4. Electric control valves.
    - 5. Sprinkler heads and swing joints.
    - 6. Quick coupler valves.
    - 7. Gate valves.
    - 8. Valve boxes.
    - 9. All related trenching and backfilling.
- 1.02 Related Work
  - A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division O and Division 1 Specification Sections, apply to work of this Section.
- 1.03 Quality Assurance
  - A. Examine all sections of Specifications and Drawings for Work related to this Section.
  - B. Install irrigation system in accordance with all applicable codes and regulations. Installer shall have had considerable experience and demonstrate ability in the installation of irrigation systems of specified type(s) in a neat, orderly, and responsible manner in accordance with recognized standards of workmanship.
  - C. Contractor shall check static pressure at the irrigation point of connection to the water supply before beginning work and notify Landscape Architect in writing of the pressure available.
  - D. Contractor shall notify the Landscape Architect and the Inspector 5 working days in advance when each work phase is ready to be inspected.
  - E. Contractor shall provide "As-Built "plans for the irrigation system per the General Conditions and prior to final acceptance of work. In addition, (1) colored coded controller chart bond copy shall be reduced in size, laminated with vinyl film, and placed in the controller enclosure, and two full size mylar copies shall be provided to the Owner.
  - F. The Contractor shall maintain continuous power and water supply to all facilities that are directly or indirectly affected by this construction, unless other arrangements are made with the Owner for temporary shut-offs.
  - G. The Contractor shall protect the public health, safety and welfare during all phases of the work.
  - H. Contractor's price shall include an amount to install ten (10) additional sprinkler

**IRRIGATION  
SECTION 32 80 00**

Central Valley Continuation High School  
DSA Submittal - Feb. 27, 2026

heads of each type and two (2) additional valves of each type and size from that quantity shown on the drawings at no additional cost to the Owner. Nozzle changes to accommodate existing conditions shall be provided at no additional cost to the District. All unused additional sprinklers shall be delivered to the District as spares prior to final payment.

- I. Crew Training for Solvent Weld PVC & Thrust Block Installation:
    - 1. The Contractor shall be required to provide crew members that will install PVC for mandatory training and certification. Contractor shall schedule training a minimum of 10 days prior to the installation of any pipe on the site.
  - J. All meetings, including training, shall be conducted in English. The Contractor shall provide an interpreter, at the Contractors expense, to translate for his/her non-English or poor English speaking representative(s).
- 1.04 Guarantee
- A. Contractor shall provide a one (1) year guarantee from the filing date of the Notice of Completion and Final Acceptance of the Work. Any pipes, valves, heads, planting, and paving, which has settled shall be reinstalled to the proper level at no cost to the District. Completely restore all damaged planting, paving, or other improvements.
- 1.05 Instruction, Training and Support
- A. Provide instruction to the District 's maintenance personnel in the operation and maintenance of the system. All warranties, product data and manuals shall be bound together with 8 1/2" by 11" reduced site irrigation plans showing zones in 9" by 12" black 3 ring binders. Contractor is to provide for one year of on-site technical support and continuing training after the filing date of the Notice of Completion by the District at no additional cost to the District.

## **Part 2 - Products**

### **2.01 Acceptable Manufacturers**

- A. Rainbird Sprinkler Mfg.
- B. Febco
- C. Matco
- D. 3M
- E. Paige
- F. Applied Engineering

### **2.02 Materials: All materials shall be as indicated on the plan, irrigation schedule and as specified herein.**

- A. Piping and Fittings:
  - 1. Polyvinyl chloride pipe:
    - a. ASTM D2241, rigid, unplasticized PVC, extruded from virgin parent material. Provide pipe homogeneous through and free from visible cracks, holes, foreign materials, blisters, wrinkles, and dents.
      - (1) Main line: Schedule 40 PVC.
      - (2) Lateral Lines: Schedule 40 PVC.
  - 2. PVC pipe fittings:

- a. Fittings for Schedule 40 PVC shall be ASTM D2241 Schedule 40 PVC molded fittings suitable for solvent weld, slip joint Ring Tite seal or screwed connections. Fittings made of other materials are not permitted.
  - (1) Sleeve main and lateral lines below walks and paving.
  - (2) PVC schedule 40 fittings w/ glued joints shall be utilized. The glue manufacturer shall furnish training for landscape contractor. Staff personnel shall be certified and wear a photo ID after receiving training.
  - (3) Size slip fitting socket taper to permit a dry unsoftened pipe end to be inserted no more than halfway into the socket. Saddle and cross fittings are not permitted.
  - (4) Use male adapters for plastic to metal connections. Hand-tighten male adapters plus one turn with a strap wrench.
- B. Gate Valves: Bronze with non-rising stem model as specified on plans. All Gate Valves are to be line size. Each valve shall have its own rectangular valve box. Provide the District with three keys prior to completion
- C. Controller Wires:
  - 1. Shall be solid copper conductors, 600 volt AC, Type UF-AWG, UL approved for direct burial. Common wire to be # 12 AWG size; station wires to be # 14 AWG size, minimum.
  - 2. Wires shall be placed adjacent to irrigation mains wherever practical within grey schedule 40 PVC conduit throughout the project.
- D. Flow Sensor: Contractor is to connect the flow sensor to the irrigation controller as per manufacturer's recommendations.
- E. Tracer Wire: All water pressure lines to be installed with #12 tracer wire except where control wires are located adjacent to pressure lines.
- F. Utility Marker Tape: Any control wires that do not follow irrigation pipes shall be 24 inches deep and marked with continuous utility marking tape located 6 inches below finish grade.
- G. Solvent: ASTM D2466 recommended by manufacturer of approved pipe.
- H. Controllers – Rainbird LXME with IQ communication cartridge as specified on plans.
  - 1. Each controller shall be installed with a separate common wire. Common wires cannot be shared between controllers.
  - 2. Locate controllers adjacent to provide power supply as indicated on plans.
- I. Control Valves: Remote Control Valves.
  - 1. Provide valves with pressure regulating feature for all tree bubbler and drip bubbler systems.
  - 2. Provide identification tag attached to valves indicating valve/station number as shown on drawings. Rainbird valve tags model #VID1Y24
  - 3. Locate valve boxes a maximum of 2' from curbs or hardscape.
  - 4. Do not provide swing joints on control valves. At all irrigation valve installations, turn PVC tee from main line to valve 90 degrees so the tee faces to the side. Size to match valve size.
  - 5. Schedule 80 TOE ("threaded one end") nipples are the only acceptable method of attaching threaded inlet/outlet valves to all irrigation piping and/or

#### IRRIGATION

#### SECTION 32 80 00

Central Valley Continuation High School

DSA Submittal - Feb. 27, 2026

fittings. At no time shall SCH 40 male adapters be used on any threaded valves to main lines.

J. Heads

1. Pop-ups sprays shall be as specified on plans.
2. All turf heads shall be mounted on triple swing joints.
3. Specify two deep root watering systems per tree.
4. Install all turf heads with swing joint assemblies.

K. Swing Joints:

1. For irrigation Heads:
  - a. 1/2" to 1" KBI Standard Series, Black Marlex - No "O" ring type
2. For Quick Couplers:
  - a. Low/Regulated Pressure Areas – 1" Rainbird TSJ Series
  - b. High Pressure Areas – 1" TSJ – PRS Series

L. Valve boxes: Valve box shall be as specified on plans.

M. Quick Couplers: Rainbird 44-LRC brass quick connect coupler disconnect coupling valve – 1" NPT or equal.

**2.03** Rain Sensor – Automatic Shut Off: Rain Guard Shut Off Device Model as specified on plans.

**2.04** Valve Tags – Shall be by T. Christy Enterprises, standard size tags, which shall be irrigation yellow color with controller letter and valve numbers hot stamped in black (ie: A-1 for controller A – Valve #1). ID Tags shall be installed prior to the punch list review.

**2.05** Trenches

- A. Fill to match adjacent grade elevations with approved earth fill material. Place and compact fill in layers not greater than 6" depth. Provide compaction of 95% over main lines where they cross under areas with concrete or AC paving. Compact all other trench backfill to 85%.
- B. Trench depth shall be minimum 18" deep for pressure lines. Lateral lines shall be a minimum of 12" deep. Under paving trench depth shall be a minimum of 24" deep. Maintain 12" of horizontal clearance between lines of other trades.

**2.06** Thrust Blocks

- A. Thrust Blocks sizes and dimensions shall be based on "Thrust Form Systems" charts for 2000 lb/ft<sup>2</sup> Soil Bearing Capacity at 150 psi.

**2.07** Fertilizer Proportioning System (Fertigation)

- A. Provide Fertigation System on irrigation system to water landscape areas.
- B. The proportioner shall be an EZ-FLO Fertilizing System or approved equal. It shall be a pressurized, non-mechanical system that operates exclusively on the differential pressure created by water flowing past inlet and outlet ports to the

IRRIGATION

SECTION 32 80 00

Central Valley Continuation High School

DSA Submittal - Feb. 27, 2026



system storage tank. It shall require no moving parts to create fertilizer flow from the tank to the irrigation line. Even metering shall be accomplished by creating a layering process inside the tank which separates incoming water from the fertilizer solution without requiring an internal bladder. Water entering the tank shall be directed to both the top of the tank and bottom of the tank to provide even metering and adequate agitation to accommodate the use of either liquid or water soluble non-hazardous fertilizers and supplements. The system shall be connected with flexible tubing and provide for easy disconnection and reconnection for subsequent removal and refill.

- C. The proportioning rates shall be adjustable from 400:1 to 15,000:1 and automatically adjust to changes in water pressure and water flow without the use of electronic meters and/or control valves.
- D. The system shall be constructed of materials conforming to a minimum of schedule 40 PVC.

### **Part 3 – Execution**

#### **3.01 Inspection**

- A. Examine final grades and installation conditions. Do not start irrigation system work until unsatisfactory conditions are corrected.

#### **3.02 Preparation**

- A. Layout and stake the location of each pipe run and all sprinkler heads and sprinkler valves. Obtain Landscape Architect's acceptance of layout prior to excavating.
- B. Strip sod for pipe trenches with a mechanical sod stripper uniformly 1" to 1-1/2" thick with clean cut edges.
- C. Place sleeves as indicated for installation of piping and conduit for control wires.

#### **3.03 Installation**

- A. Excavating and backfilling:
  - 1. All excavation shall be considered unclassified excavation and include all materials encountered.
  - 2. Excavate trenches to depth and width indicated on drawings to permit proper handling and installation of pipe and fittings.
  - 3. Fill to match adjacent grade elevations with approved earth fill material. Place and compact fill in layers not greater than 6" depth.
  - 4. Provide compaction of 95% over main lines where they cross under areas with concrete or AC paving. Compact all other trench backfill to 90%.
  - 5. Replace stripped sod in sufficient time to allow for satisfactory sod recovery and growth. Water stripped and reinstalled sod until irrigation system is placed in operation.
  - 6. Replace paving of same materials, using joints and patterns to match existing adjoining paving surfaces.
- B. Plastic Pipe:
  - 1. Install plastic pipe in accordance with manufacturer's installation instructions. Provide for thermal expansion and contraction.
  - 2. Saw cut plastic pipe. Use a square-in sawing vice, to insure a square cut. Remove burrs and shavings at cut ends prior to installation.

#### **IRRIGATION**

#### **SECTION 32 80 00**

Central Valley Continuation High School

DSA Submittal - Feb. 27, 2026

3. Make plastic-to-plastic joints with solvent weld joints for slip seal joints. Use only solvent recommended by the pipe manufacturer. Install plastic pipe fittings in accordance with pipe manufacturer's instructions. Contractor shall make arrangements with pipe manufacturer for all necessary field assistance.
  4. Make plastic to metal joints with plastic male adapters.
  5. Make solvent weld joints in accordance with manufacturer's recommendations.
  6. Allow joints to set at least 24 hours before pressure is applied to the system.
  7. Maintain pipe interiors free of dirt and debris. Close open ends of pipe by acceptable methods when pipe installation is not in progress.
- C. Sprinklers, fittings, valves, and accessories:
1. Install fittings, valves sprinkler heads, risers and accessories in accordance with manufacturer's instructions, except as otherwise indicated.
  2. Set sprinkler heads perpendicular to finished grade and 2 inches from pavement edge, except as otherwise indicated. Nozzle changes shall be made at no cost to the District.
  3. Obtain Landscape Architect's review and acceptance of height for proposed sprinkler heads and valves prior to installation.
  4. Locate sprinkler heads to assure proper coverage of indicated areas. Do not exceed sprinkler head spacing distance indicated.
  5. All turf heads should be mounted on triple swing joints.
  6. Install controller(s) as detailed.
  7. Install in-ground control valves in a valve access box as indicated.
  8. Install valve access boxes on a suitable base of gravel to provide a level foundation at proper grade and to provide drainage of the access box.
  9. Seal threaded connection on pressure side of control valves with Teflon tape or approved plastic joint type compound.
- D. Quick Coupling Valves
1. Install quick-coupling valves with an adjustable triple swing joint riser by Rainbird or Lasco.
  2. Install in valve boxes with the top flush with the finish grade, 2 inches from the pavement and heads. Furnish 3 valve keys with inverted hose bibbs and 3 swivel hose ells to the IOR along with the required spare irrigation parts prior to substantial completion.
- E. Control Wiring:
1. Install control wire in the piping trenches wherever possible.
    - a. Place control and common wires within grey sch 40 conduit in trench adjacent to irrigation mainline pipe as per installation detail.
    - b. Install wire with slack to allow for thermal expansion and contraction.
    - c. Expansion joints in wire to be provided at 200-foot intervals by making 5-6 turns of the wire around a piece of 1/2" pipe instead of slack.
    - d. Where necessary to run wire in a separate trench, provide a minimum cover of 18" as detailed.
  2. Provide sufficient slack at site connections at remote control valve in control boxes and at all wire splices to allow raising the valve bonnet or splice to the surface without disconnecting the wires when repair is required.
  3. Connect each remote control valve to one station of a controller except as otherwise indicated.
  4. Connect each remote control valve to a common ground wire system independent of all other controllers.

#### IRRIGATION

#### SECTION 32 80 00

Central Valley Continuation High School

DSA Submittal - Feb. 27, 2026

5. Make wire connection to remote control electric valves and splices of wire in the field, using wire connectors and sealing cement in accordance with manufacturer's recommendations.
  6. Provide tight joints to prevent leakage of water and corrosion build-up on the joint.
  7. Wire splices shall only be made in accessible valve boxes.
  8. Utilize sleeves for installation of the irrigation system where indicated on drawings.
  9. Provide new sleeves for all locations where existing sleeves are not indicated. Install new sleeve prior to paving installation wherever possible.
  10. Remove and replace existing concrete and asphalt surfaces where cutting is necessary. Obtain District's and Architect's permission before cutting existing concrete and asphalt.
- F. Flushing, testing, and adjustment:
1. After sprinkler piping and risers are installed and before sprinkler heads are installed, open control valves and flush out the system with full head of water.
  2. Perform system testing upon completion of each section. When main line installation has been completed, pressurize to 125 pounds for a period of 6 hours. Inspector and Landscape Architect shall observe test. Make necessary repair and re-test repaired sections as required.
  3. Adjust sprinklers after installation for proper and adequate distribution of the water over the coverage pattern. Adjust for the proper arc of coverage.
  4. Tighten nozzles on spray type sprinklers after installation. Adjust sprinkler adjusting screw on lateral line or circuit as required for proper radius. Interchange nozzles patterns as directed by the Landscape Architect, to give best arc of coverage.
  5. Adjust all electric remote control valve pressure regulators and flow control stems for system balance and optimum performance.
  6. Test and demonstrate the controller by operating appropriate day, hour, and station selection features as required of each season per Service section below.

**3.04 Disposal of Waste Material**

- A. Stockpile, haul from site, and legally dispose of waste materials, including unsuitable excavated materials, rock, trash, and debris.
- B. Maintain disposal route clear, clean, and free of debris.

**3.05 Acceptance**

- A. Test and demonstrate to the Landscape Architect and District satisfactory operation of the system free of leaks.
- B. Instruct the District 's designated personnel in the operation of the system, including adjustment of sprinklers, controller(s), valves, pump controls, and moisture sensing controls.
- C. Upon acceptance the District will assume operation of the system.
- D. All record documents must be approved and submitted prior to final payment per the General Conditions.

**3.06 Cleaning**

- A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment. Repair damage resulting from irrigation system installation.
- B. Extreme care shall be taken by the landscape contractor when backfilling of trenches. They shall be left flush with the existing surrounding soil level. Tamp soil and rake level to make level bed for turf to re-establish.

**END OF SECTION**

**SEEDING  
SECTION 32 92 19**

**PART 1      GENERAL INFORMATION**

**1.01      SUMMARY**

- A. Inclusions:
  - 1. Provisions set forth in Divisions 0 and 1
  - 2. Soil preparation
  - 3. Hydroseeding turf
  - 4. Fertilizing
  - 5. Maintenance
  - 6. Submittal preparation
  - 7. Clean up
- B. Related Sections:
  - 1. Section 32 80 00:      Irrigation
  - 2. Section 32 92 23:      Sodding
  - 3. Section 32 93 00:      Trees, Plants, and Ground Cover

**1.02      SUBMITTALS**

- A. Submit seed vendor's certification for required grass seed mixture.
  - 1. Indicate percentage by weight, and percentages of purity, germination, and weed seed for each seeded lawn.

**1.03      QUALITY ASSURANCE**

- A. Warranty:
  - 1. Provide a uniform stand of grass by watering, mowing, and maintaining seeded areas until final acceptance.
    - a. Reseed areas with specified materials which fail to provide a uniform stand of grass until all affected areas are accepted by the Landscape Architect.

**1.04      PROJECT CONDITIONS**

- A. Notify Landscape Architect at least 7 working days prior to start of seeding operations.
- B. Protect existing utilities, paving, and other facilities from damage caused by seeding operations.
- C. Perform seeding work only after planting and other work affecting ground surface has been completed.
- D. Restrict traffic from lawn areas until grass is established.
  - 1. Erect signs and barriers as required.
- E. Provide hose and lawn watering equipment as required.
- F. Install irrigation system prior to seeding.
  - 1. Locate, protect, and maintain the irrigation system during seeding operations.
  - 2. Repair irrigation system components damaged during seeding operations at this

**SEEDING  
SECTION 32 92 19**

**Central Valley Continuation High School  
DSA Submittal - Feb. 27, 2026**

Contractor's expense.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Hydroseed mix for turf areas shall be as follows by volume:
  - 1. Perennial Rye: 25%
  - 2. Fescue Mix: 25%
  - 3. Hulled Bermuda: 50%
- B. The above mix to be applied at 10 pounds per 1,000 sq. ft., equal in weight for each type grass seed.
- C. Seeds shall be dated for the current growth season.
- D. In addition, the following shall be included in the mix:
  - 1. Wood Cellulose Fiber Mulch: 45 pounds 1000 sq. ft.
  - 2. 12-08-08 Slow Release Fertilizer (Best Brand) at the rate of 10 pounds per 1000 sq. ft.
    - a. Fertilizer shall be delivered to the site in original, unopened container, bearing manufacturer's guaranteed analysis.
      - 1) Fertilizer that is delivered caked or damaged will not be acceptable.
- E. Incorporate soil amendments throughout entire depth of planting zone.
  - 1. Areas to be planted and irrigated shall receive soil amendments.
  - 2. The following soil amendments shall be incorporated per 1,000 square feet of soil surface area:
    - a. Three (3) cubic yards organic amendment.
      - 1) Material shall be organic wood-based product consisting of redwood or fir only.
      - 2) Material shall contain no manure of any kind, weed seeds, or any foreign substance.
      - 3) Maximum particle size shall be 1/4".
      - 4) Product shall contain a minimum 1% available nitrogen.
    - b. 5 lbs. soil sulfur.
    - c. 15 lbs. Best Brand Triple 16 Fertilizer.
    - d. 250 lbs. crystallized agricultural gypsum.
    - e. A copy of delivery slips on all materials used on the project shall be delivered to the Owner.
      - 1) Delivery slips shall be provided at time of material delivery to site.
        - Delivery will not be allowed without delivery slips on any items.

**Note:** After import soil is in place, a soil suitability and fertility analysis of planted areas shall be made by a soils laboratory. If recommendations for soil amendment according to test results exceed the above quantities, the Contractor will be reimbursed for an extra based on unit costs submitted with original bid for soil amendments required in excess of the above quantities.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

#### **SEEDING SECTION 32 92 19**

**Central Valley Continuation High School  
DSA Submittal - Feb. 27, 2026**

- A. Remove foreign materials, plants, roots, stones, and debris from areas to be planted or seeded.
  - 1. At time of planting, areas to be planted or seeded shall be free of stones, stumps, roots, or other deleterious matter 1" in diameter or larger and shall be free from all wire, plaster, or similar objects that would be a hindrance to planting or maintenance.
- B. Protect existing underground improvements from damage.
- C. Remove contaminated subsoil.
- D. Cultivate all planting areas by ripping to a depth of 12 inches with an agricultural implement designed for that purpose. Rip area in two directions, perpendicular to each other.
  - 1. Repeat cultivation areas where equipment has compacted subgrade.

### 3.02 DELIVERY, STORAGE, AND HANDLING

- A. Deliver seed and fertilizer materials in original, unopened containers, showing weight, analysis, and name of manufacturer.
- B. Store in a manner to prevent wetting and deterioration.

### 3.03 INSTALLATION

- A. After preparation of soil has been completed, the areas to be seeded shall be brought to a finish grade with the finish surface being smooth and even, and well-firmed.
  - 1. Contractor shall make the entire area smooth and even.
  - 2. Contractor shall insure that finish grades are generally one inch below the surface of walks, curbs, paved areas, and yard boxes without abrupt changes in gradient (yard boxes shall be level and 1/2" above grade).
- B. The ground surface shall be inspected by the Landscape Architect prior to seeding to determine suitability for planting.
  - 1. The Contractor shall obtain such approval before seeding.
- C. Seed types shall be as specified and shall be applied at the rate indicated.
- D. Equipment and Application:
  - 1. Hydraulic equipment used for the application of slurry shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix the above slurry.
  - 2. Distribution lines shall be large enough to prevent stoppage and to provide even distribution of the slurry over the ground.
  - 3. The pump shall be capable of exerting at least 150 psi at the nozzle or sufficient additional pressure for proper coverage.
  - 4. The slurry tank shall have a minimum capacity of 1,500 gallons and shall be mounted on a traveling unit which will place the slurry tank and spray nozzles within sufficient proximity of the areas to be seeded so as to provide uniform distribution without waste and shall be thoroughly clean and free of seed species that are not specified.
  - 5. With the engine at half throttle, water shall be added to the tank. When the water level has reached the height of the agitator shaft, good re-circulation shall be

## SEEDING SECTION 32 92 19

**Central Valley Continuation High School  
DSA Submittal - Feb. 27, 2026**

established and, at this time, the seed shall be added. Fertilizer shall then be added to the mixture followed by wood pulp mulch. The wood pulp mulch shall only be added to the mixture after the seed, and when the tank is at least one-third filled with water. The engine throttle shall be opened to full speed when the tank is half filled with water. The engine throttle shall be opened to full speed when the tank is half filled with water. All the wood pulp mulch shall be added by the time the tank is two-thirds to three-fourths full. Spraying shall commence when the tank is full.

6. Spray with a uniform, visible coat.
7. The slurry shall be applied in a sweeping motion, in an arched stream so as to fall like rain allowing the wood fibers to build on each other until a good coat is achieved and the material is spread at the required rate per acre.
8. Slurry mixture which has not been applied to the slopes within four hours after mixing will be rejected and removed from the project at the Contractor's expense.

E. Watering Should be as Follows:

1. Prior to Hydroseed, the area shall be irrigated in order to provide a moist seed bed for the Hydroseed application.
2. Hydroseed areas shall receive several consecutive waterings the day of the Hydroseed to thoroughly saturate the soil.
3. After initial irrigation, water shall be applied as often and in sufficient amounts as conditions may require, to keep the soil wet above, around, and below the root systems of the plants (until germination is complete).

3.04 EARLY SEEDING OF TURF PLAYFIELD

- A. After installation of irrigation system, Contractor shall complete seeding turf playfield by April 1st of the year following the start of the project. Contractor maintenance period for this turf shall begin when seeding has been completed. Contractor shall remain responsible for maintenance until the maintenance period for the entire project is completed.

3.05 MAINTENANCE PERIOD

- A. Maintain seeded lawns for a period of at least 90 days after completion and acceptance of seeding operations for the entire project.
- B. Maintain seeded lawn areas, including watering, spot weeding, mowing, applications of herbicides, fungicides, insecticides, and re-seeding until a full, uniform stand of grass free of weeds, undesirable grass species, disease, and insects is achieved and accepted by the Landscape Architect.
  1. Water daily to maintain adequate surface soil moisture for proper seed germination.
  2. Maintenance Period work includes all mowing (at height approved by Owner), watering, weeding, reseeding, mulching, cultivating, spraying, and trimming necessary to bring the planted areas to healthy growing conditions, and any additional work needed to keep the areas neat, edged, and attractive.
  3. Any day the Contractor fails to adequately water, replace unsuitable plants, weed, and other work determined to be necessary by the Landscape Architect, he will NOT be credited as part of the Maintenance Period.
  4. Constant diligence shall be maintained for the advent of disease, insects, and/or

**SEEDING  
SECTION 32 92 19**

**Central Valley Continuation High School  
DSA Submittal - Feb. 27, 2026**



- rodent infestations, and proper preventative or control measures taken.
5. On the 90th day of the Maintenance Period, all lawn areas shall receive 25 pounds of Best Brand Triple 16 Fertilizer per 1,000 sq. ft., or approved equal.
  6. At completion of Maintenance Period, all areas included in the Contract shall be substantially clean and free of debris and seeds, and plant materials shall be alive, healthy, and free of infestations.
  7. Any erosion or slippage of soil caused by watering shall be repaired by the Contractor at his expense.
  8. All walks, curbs, and gutters shall be kept clear of debris, mud, dust, and standing water by sweeping, mopping, or hosing down as required to maintain cleanliness throughout.
  9. The Contractor, within fourteen (14) days of written notification by the Owner, shall remove and replace all guaranteed plant materials that for any reason fail to meet the requirements of the guarantee.
  10. All plant material replaced shall be guaranteed for the original period, starting from the date of replacement.
  11. Contractor shall provide a temporary barrier string line with colored flags between new turf area and general play area until turf is established and is ready for play.

### 3.06 ACCEPTANCE

- A. Inspection to determine acceptance of seeded lawns will be made by the Landscape Architect, upon Contractor's request.
  1. Provide notification at least 10 working days before requested inspection date.
  2. Seeded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, uniform, close stand of the specified grass is established free of weeds, undesirable grass species, disease, and insects.
  3. No individual lawn areas shall have bare spots or unacceptable cover totaling more than 2% of the individual areas, in areas requested to be inspected.
- B. Upon acceptance, the Owner will assume lawn maintenance.

### 3.07 CLEAN UP

- A. Perform clean up during installation of the work and upon completion of the work.
  1. Remove from site all excess materials, debris, and equipment.
  2. Repair damage resulting from seeding operations.

## END OF SECTION

### SEEDING SECTION 32 92 19

Central Valley Continuation High School  
DSA Submittal - Feb. 27, 2026

**SODDING**  
**SECTION 32 92 23**

**DIVISIONS 00 AND 01 ARE A PART OF THIS SECTION**

**Part 1 – General**

- 1.01 Summary
  - A. Description of Work
    - 1. All labor, materials, tools and the transportation and performance of all work required as per specifications
      - a. Place and rototill soil amendments
      - b. Prepare subgrade to receive soil amendments
      - c. Rake and level by fine grading to plans
      - d. Certification of existing grades
      - e. Install sod
      - f. Maintenance
      - g. Guarantee
      - h. Clean up of site
  - B. Related Work
    - 1. General and supplemental conditions
    - 2. Irrigation
    - 3. Grading
- 1.02 Delivery, Storage and Handling
  - A. Sod shall be delivered and installed within 24 hours of harvest at anytime of the year. Sod not installed within this period shall be inspected and approved by the Landscape Architect or the owner's representative prior to its installation.
  - B. Sod strength shall be such that the sod rolls on slabs may be handled, lifted and moved w/o substantial breaking or tearing.
  - C. Substitutions will not be permitted unless specified sod is not available. Any substitutions require the approval of the Landscape Architect.
- 1.03 Project Conditions
  - A. Notify Landscape Architect at least 7 working days prior to start of installations operations.
  - B. Contractor shall verify actual site conditions and report any discrepancies between the plans and actual conditions to the District and stop doing any work in areas to be sodded.
  - C. Protect existing utilities, paving and other facilities from damage caused by sod installation operations.
  - D. Perform sod installation work only after planting or other work affected ground surface has been completed
  - E. Restrict and redirect all foot traffic from new grass before it is established by staking with colored tape, to indicate new sodded areas.
  - F. At the completion of grading the Contractor shall install the irrigation system prior to installation of sod.
- 1.04 Quality Control

- A. Contractor is to be fully informed regarding the management and control of fugitive dust and shall comply with all current San Joaquin Valley Air Pollution Control District "Visible Dust Emissions" (VDE) requirements.
  - B. Additionally, protect storage piles and bulk materials as required to comply w/VDE requirements.
  - C. Contractor shall be a licensed C-27 Landscape Contractor and shall have a minimum of five years experience.
- 1.05 Warranty
- A. Provide a uniform stand of grass by watering, mowing and maintaining sod areas until final acceptance.
    - 1. Replace sod areas with specified materials which fail to provide a uniform stand of grass until all affected areas are accepted by the Landscape Architect.

## **Part 2 - Products**

### **2.01 Materials**

- A. Sod
  - 1. Sod shall be freshly harvested grown from high quality propagated material on Methyl Bromide fumigated soil with appropriate State and Federal regulatory agency approved pesticides and herbicides for control of disease, insects and weeds. Sod shall meet or exceed the standards of the State of California regulations for nursery inspection.
  - 2. Cutting Sod
    - a. Sod shall be cut by machine to a thickness of between 1/4" and 5/8", not including top growth or thatch.
    - b. Size of rolls or slabs shall be consistent to the supplier's standards width and length and may not vary more than 2% in either dimension. Top growth shall be uniform in 1/2" to 3/4" and of good color, free of debris.
    - c. Sod moisture content shall be neither too wet nor too dry at the time of harvest to adversely affect its ability to be transplanted.
- B. Soil Amendments

Areas to be planted with sod and irrigated shall receive soil amendments.

- 1. The following soil amendments shall be incorporated into the soil prior to planting.
    - a. Four (4) cubic yards compost shall be incorporated per 1000 sq. ft. of soil surface area and rotor-tilled to depth of 6".
    - b. Live Earth Liquid 6%- Drench at 32 oz. per 1000 sq. ft.
    - c. Humate soil conditioner - @ 300 lbs per 1000 sq. ft. spread evenly after tilling, grading, and before planting.
    - d. Live Earth Blitz 22 product - @ 20 lbs per 1000 sq ft.
    - e. A copy of delivery slips on all materials used on the project shall be delivered to the authorized District representative.
  - 2. Delivery slips shall be provided at time of material delivery to site. Delivery will not be allowed without delivery slips on any items.
- C. Water
- 1. Water shall be clean, fresh and free of substances of matter that would inhibit growth of sod grass.

### **SODDING**

### **SECTION 32 92 23**

Central Valley Continuation High School  
DSA Submittal - Feb. 27, 2026

## **Part 3 – Execution**

### **3.01 Grades, Soil Preparations and Certification**

- A. Finish Grades
  - 1. Coordinate soil preparation work with the requirements for finish grading
- B. Weed, Debris, Clods and Rock removal
  - 1. All Areas to be planted shall be cleared of all weeds and debris prior to soil preparation and finish grading.
  - 2. At time of planting areas to be sodded shall be free of stones, stumps, roots or other deleterious matter 1" in diameter or larger and shall be free from all wire, plaster or similar objects that would be a hindrance to planting or maintenance.
- C. Protect existing underground improvements from damage.
- D. The contractor shall have the final grade certified by a surveyor licensed in the State of California. The final grades shall be within the tolerances specified in this section.

### **3.02 Installation**

- A. After preparation of soil has been completed, the areas to receive sod shall be brought to finish grade.
  - 1. Contractor shall make the entire area smooth, even and well firmed.
  - 2. Contractor shall insure that finish grades are generally one (1) inch below the surface of walks, curbs, paved areas and boxes without abrupt changes in gradient.
- B. The ground surface shall be inspected by the Landscape Architect prior to sod installation to determine suitability for planting.
  - 1. The Contractor shall obtain such approval prior to installation.
- C. Sod type shall be Celebration bermuda grass sod, as specified on the plans, and shall be delivered and installed within 24 hours of harvest anytime of the year, unless approval is given for a specific preservation technique.
- D. Fertilize
  - 1. Apply fertilizer as specified in "Soils Amendments" section.
  - 2. Lightly water to aid the breakdown of the fertilizer.
  - 3. Apply fertilizer within 48 hours before laying sod.
- E. Laying Sod
  - 1. Lay sod as soon as possible after delivery to prevent deterioration.
  - 2. Lay sod closely knit together with no one joint visible and pieces not overlapped. Lay smooth and flush with adjoining paving, curbing or other sod strips.
  - 3. Immediately water sod areas after installation. Water in sufficient amounts to saturate sod and upper 6" of soil.
  - 4. After sod and soil has dried sufficiently to prevent damage, roll sod areas to insure a good bond between sod and soil and to remove minor depression and irregularities. Insure rolling equipment weight to be not more than 250 lbs. or less than 150 lbs.

### **3.03 Maintenance Period**

- A. Maintain sod areas immediately after placement for a period of 90 days. This constitutes firm attachment to the soil by the sod and exhibits a vigorous growing condition as agreed to by the Landscape Architect and the District.

## **SODDING**

## **SECTION 32 92 23**

**Central Valley Continuation High School  
DSA Submittal - Feb. 27, 2026**

- B. Mow grass at regular intervals, weekly, or as required to maintain grass at a height of 1/2" to 1". Do not cut more than 1/3 of grass blade at any one mowing. Neatly trim edges and hand clip where necessary. Immediately remove all clippings after mowing and trimming. Contractor shall be responsible for a minimum of three mowings and more as required by the Landscape Architect depending on the growth of the lawn.
- C. Water when required and in sufficient quantities to prevent grass and underlying soil from drying out.
- D. Roll when required to remove minor depressions or irregularities.
- E. Control growth of weeds. When using herbicides, apply in accordance with manufacturer's recommendations. Remedy damage resulting from negligent or improper use of herbicides.
- F. Immediately repair or replace any areas that show deterioration or bare spots.
- G. Protect sod areas with warning signs during maintenance period.
- H. Six weeks after installation begin fertilization program as indicated on the plans.

#### 3.04 Acceptance

- A. Inspection to determine acceptance of sod lawns will be made by the Landscape Architect, upon Contractor's request.
  - 1. Provide notification, at least 10 working days before requesting inspection date.
  - 2. Sod areas will be acceptable provided all requirements, including maintenance, have been completed with, and a healthy uniform close stand of the specified grass is established free of weeds, undesirable grass species, disease and insects.
- B. Upon acceptance, the Owner will assume lawn maintenance.

#### 3.05 Cleanup

- A. Perform cleanup during installation of the work and upon completion of the work.
  - 1. Remove from site all excess materials, debris and equipment.
  - 2. Repair damage resulting from sod installation operations.

### **END OF SECTION**

**TREES, PLANTS AND GROUND COVER  
SECTION 32 93 00**

**DIVISIONS 00 AND 01 ARE A PART OF THIS SECTION**

**PART 1      GENERAL INFORMATION**

**1.01      SUMMARY**

- A. Inclusions:
  - 1. Provisions set forth in Divisions 0 and 1
  - 2. Soil preparation
  - 3. Trees, plants, and ground covers
  - 4. Planting mixes
  - 5. Mulch and planting accessories
  - 6. Maintenance
  - 7. Submittal preparation
  - 8. Clean up.
- B. Related Sections:
  - 1. Section 32 80 00:      Irrigation
  - 2. Section 32092023:      Sodding

**1.02      QUALITY ASSURANCE**

- A. Plant names indicated shall comply with "Standardized Plant Names" as adopted by the latest edition of the American Joint Committee of Horticultural Nomenclature.
- B. Names of varieties not listed conform generally with names accepted by the nursery trade.
- C. Provide stock true to botanical name and legibly tagged.
- D. Comply with sizing and grading standards of the latest edition of "American Standard for Nursery Stock". A plant shall be measured as it stands in its natural position.
- E. All plants shall be nursery grown under climatic conditions similar to those in the locality of the project for a minimum of 2 years.
- F. Stock furnished shall be at least the minimum size indicated.
  - 1. Larger stock is acceptable, at no additional cost, providing that the larger plants will not be cut back to size indicated.
- G. Plants may be inspected and approved at the place of growth, for compliance with specification requirements for quality, size, and variety.
  - 1. Such approval shall not impair the right of inspection and rejection upon

**TREES, PLANTS AND GROUND COVER  
SECTION 32 93 00**

Central Valley Continuation High School  
DSA Submittal - Feb. 27, 2026

delivery at the site or during the progress of the work.

H. Warranty:

1. Warrant plant material to remain alive and be in healthy vigorous condition for a period of 1 year after completion and acceptance of entire project.
  - a. Inspection of plants will be made by the Landscape Architect at completion of planting.
2. Replace plants that are dead as determined by the Landscape Architect, or are in an unhealthy or unsightly condition, or have lost their natural shape due to dead branches, or other causes, at the Contractor's expense.
  - a. Warrant all replacement plants for 1 year after installation.

1.03 PROJECT CONDITIONS

- A. Notify Landscape Architect at least 7 working days prior to installation of plant material.
- B. Protect existing utilities, paving, and other facilities from damage caused by landscape operations.
- C. In the event that quantity discrepancies or material omissions occur in the plant materials list shown on the drawings, the planting plans shall govern.
- D. The irrigation system will be installed prior to planting.
  1. Locate, protect, and maintain the irrigation system during planting operations.
  2. Repair irrigation components damaged during planting operation at the Contractor's expense.

**PART 2 PRODUCTS**

2.01 MATERIALS

- A. Provide plants typical of their species or variety; with normal, densely developed branches and vigorous root systems.
  1. Provide only sound, healthy, vigorous plants free from defects, disfiguring knots, sunscald injuries, frost cracks, abrasions of the bark, plant diseases, insect eggs, borers, and all forms of infestation.
  2. Plants shall have a fully developed form without voids and open spaces.
    - a. Plants held in storage will be rejected if they show signs of growth during storage.
- B. Container-growth stock: Grown in a container for sufficient length of time for the root system to have developed to hold its soil together, firm, and whole.
  1. No plants shall be loose in the container.
    - a. Container stock shall not be pot bound.
- C. Provide tree species that mature at heights over 25'-0' with a single trunk. Trees that have the main trunk forming a "Y" shape are not acceptable.

**TREES, PLANTS AND GROUND COVER**

**SECTION 32 93 00**

Central Valley Continuation High School  
DSA Submittal - Feb. 27, 2026

- D. Plants planted in rows shall be matched in form.
- E. Plants larger than those specified in the plant list may be used when acceptable to the Landscape Architect.
- F. The height of the trees, measured from the crown of the roots to the top of the branch, shall not be less than Industry standard for each plant species and variety.
- G. No pruning wounds shall be present with a diameter of more than 1" and such wounds must show vigorous bark on all edges.
  - 1. Evergreen trees shall be branched to the ground.
- H. Shrubs and small plants shall meet the requirements for the industry standard spread and height for said species and variety.
  - 1. The measurement for the height shall be taken from the ground level to the average height of the plant and not the longest branch.
  - 2. Single-stemmed or thin plants will not be accepted.
  - 3. Side branches shall be generous, well-twigged, and the plant as a whole well-bushed to the ground.
  - 4. Plants shall be in a moist, vigorous condition, free from dead wood, bruises, or other root or branch injuries.
- I. Replace plant materials found dead or not in a healthy growing condition.
  - 1. Plants that die or lose more than 30% of their original leaves shall be replaced under this Section.
  - 2. Replace plant materials of same size and species, with a new warranty commencing on date of replacement.
- J. Trees, Plants, and Ground Cover shall be species and size-identified in plant schedule, grown in climatic conditions similar to close locality of the work.
- K. Plants shall be symmetrical, typical for variety and species, sound, healthy, vigorous, free from plant disease, insect pests or their eggs, excessive abrasions or other objectionable disfigurements, and shall have healthy, normal root systems, well filling their containers, but not to the point of being root bound. Tree trunks shall be sturdy and well hardened off.
- L. Substitutions for the indicated plant materials will be permitted.
  - 1. Provided the substitute materials are approved in advance by the Landscape Architect and the substitutions are made at no additional cost to the Owner.
  - 2. Except for the variations so authorized, all substitute plant materials shall conform to the requirements of these specifications.
  - 3. If accepted, substitute materials are of less value than those indicated or specified, the Contract price will be adjusted in accordance with the provisions of the Contract.

TREES, PLANTS AND GROUND COVER  
SECTION 32 93 00

Central Valley Continuation High School  
DSA Submittal - Feb. 27, 2026



- M. Plant Inspection and Rejection: Root condition of plants will be determined by the Landscape Architect through the removal of earth from the roots of at least two (2) plants but not more than 2% of the total number of species from each source.

## 2.02 SOIL AMENDMENTS

- A. Areas to be planted and irrigated shall receive soil amendments.
  - 1. The following soil amendments shall be incorporated into the soil prior to planting.
    - a. Four (4) cubic yards compost shall be incorporated per 1000 sq. ft. of soil surface area and rotor-tilled to depth of 6".
    - b. Live Earth Liquid 6%- Drench at 32 oz. per 1000 sq. ft.
    - c. Humate soil conditioner - @ 300 lbs per 1000 sq. ft. spread evenly after tilling, grading, and before planting.
    - d. Live Earth Blitz 22 product - @ 20 lbs per 1000 sq ft.
    - e. A copy of delivery slips on all materials used on the project shall be delivered to the authorized District representative.
  - 2. Delivery slips shall be provided at time of material delivery to site. Delivery will not be allowed without delivery slips on any items.
  - 3. If import soil is to be used, a soil suitability and fertility analysis of the soil shall be conducted by a soils laboratory. Submit test results and recommendations for soil amendment to the Landscape Architect for review. If recommendations for soil amendment according to test results exceed the above quantities, the Contractor will be reimbursed for an extra based on unit costs submitted with original bid for soil amendments required in any of the above quantities.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Remove foreign materials, plants, roots, stones, and debris from areas to be planted.
  - 1. At time of planting, areas to be planted shall be free of stones, stumps, roots, or other deleterious matter 1" in diameter or larger and shall be free from all wire, plaster, or similar objects that would be a hindrance to planting or maintenance.
- B. Protect existing underground improvements from damage.
- C. Any and all contaminated soil shall be removed and replaced with acceptable fertile import soil as determined by soils analysis.

## TREES, PLANTS AND GROUND COVER SECTION 32 93 00

Central Valley Continuation High School  
DSA Submittal - Feb. 27, 2026

- D. Cultivate all planting areas by ripping to depth of 12 inches with an agricultural implement designed for that purpose. Rip area in two directions, perpendicular to each other.
  - 1. Repeat cultivation areas where equipment has compacted subgrade.
- E. Excavate circular plant pits with vertical sides, except for plants specifically indicated to be planted in beds.
  - 1. Provide plant pits twice the width of the diameter of the root system for all the trees and shrubs.
  - 2. Depth of pit shall accommodate the container root ball, such that the top of the root crown shall be 1" above finish grade.
  - 3. Scarify the bottom of the pit to a depth of 4".
  - 4. Remove excavated materials from the site.

### 3.02 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fertilizer materials in original, unopened, and undamaged containers, showing weight, analysis, and the name of manufacturer.
- B. Store in manner to prevent wetting and deterioration.
- C. Take precautions in preparing plants for moving.
  - 1. Spray deciduous plants in foliage with an approved "Anti-Desiccant" immediately after digging to prevent dehydration.
  - 2. Dig, pack, transport, and handle plants with care to ensure protection against injury.
  - 3. Inspection certificates required by law shall accompany each shipment invoice or order to stock and on arrive, the certificate shall be filed with the Landscape Architect.
  - 4. Protect plants from drying out.
    - a. If plants cannot be planted immediately upon delivery, properly protect them with oil, wet peat moss, or in manner acceptable to the Landscape Architect.
    - b. Water heel-in plantings daily.
  - 5. No plant shall be bound with rope or wire in a manner that could damage or break the branches.
- D. Cover plants transported on open vehicles with protective covering to prevent wind burn.
- E. Reject plants when ball of earth surrounding roots has been cracked or broken preparatory to or during planting.
- F. Provide dry, loose topsoil for planting bed mixes. Frozen or muddy topsoil is not acceptable.

### 3.03 INSTALLATION

- A. Planting shall be performed only by experienced workmen familiar with planting

#### TREES, PLANTS AND GROUND COVER

#### SECTION 32 93 00

Central Valley Continuation High School

DSA Submittal - Feb. 27, 2026

procedures under the supervision of a qualified supervisor.

- B. Locate plants as indicated or as approved in the field after staking by the Contractor.
  - 1. If obstructions are encountered that are not shown on the drawings, do not proceed with planting operations until alternate plant locations have been selected.
- C. Set plant material in the planting pit to proper grade alignment.
- D. Set plants upright, plumb, and faced to give the best appearance or relationship to each other or adjacent structure.
- E. Set plant material 1" above the finished grade.
- F. No filling will be permitted around trunks or stems.
- G. Backfill the pit with planting mixture.
  - 1. Do not use frozen or muddy mixtures for backfilling.
  - 2. Form a ring of soil around the edge of each planting pit to retain water.
  - 3. Backfill mix shall be equal parts of native soil and sand, plus the soil amendments indicates below.
  - 4. The Backfill mix blend to contain the following:
    - a. Humate Soil Conditioner - 45% humic @ approx .5 lb or 1 cup. per gallon container size.
    - b. 'Aquasmart Pro' moisture retention product at the following rates -

24" box-	2.5 cups
5 gallon-	1/3 cup
1 gallon-	2 tablespoons
- H. Space ground cover plants in accordance with the plans.
  - 1. Adjust spacing as necessary to evenly fill planting bed with indicated quantity of plants.
- I. Mulching:
  - 1. Install 3" thick layer of decomposed granite mulch within all shrub beds, immediately after planting. Thoroughly water mulched areas. After watering, rake mulch to provide a uniform finished surface.
  - 2. Tree and shrub root crowns shall not be covered with mulch material.
- K. Tree Staking:
  - 1. Inspect trees for injury to trunks, evidence of insect infestation, and improper pruning before wrapping.
  - 2. Staking:
    - a. Stake all trees immediately after lawn seeding or sodding operations, and prior to acceptance.
  - 3. All work shall be subject to acceptability of the Landscape Architect.
- L. Pruning:

TREES, PLANTS AND GROUND COVER  
SECTION 32 93 00

Central Valley Continuation High School  
DSA Submittal - Feb. 27, 2026

1. Pruning branches of deciduous stock after planting to balance the loss of roots and preserve the natural character appropriate to the particular plant requirements.
  - a. In general, remove 1/4 to 1/3 of the leaf bearing buds. Proportion shall, in all cases be acceptable to the Landscape Architect. Remove or cut back broken, damaged, and non-symmetrical growth of new wood.
2. Multiple Leader Plants: Preserve the leader that will best promote the symmetry of the plant.
  - a. Cut branches flush with the trunk or main branch, at a point beyond a lateral shoot or bud a distance of not less than 1/2 the diameter of the supporting branch.
    - 1) Make cut on an angle.
3. Prune evergreens only to remove broken or damaged branches.

M. Care of Existing Trees:

1. Water existing trees every 2 weeks until acceptance.
2. Water thoroughly with a fine mist spray head, soaker hose, or hose at a low flow rate over the entire drip line area as required to allow water to penetrate to a depth of 12" to 18".

### 3.04 INSPECTION

- A. Examine proposed planting areas and conditions of installation.
  1. Do not start planting work until unsatisfactory conditions are corrected.

### 3.05 MAINTENANCE

- A. Planted and turf areas will be inspected at completion of installation and accepted to compliance with specified materials and installation requirements.
- B. After all work indicated on the drawings or herein specified has been completed, inspected, and approved by the Landscape Architect, the Contractor shall commence a ninety (90) day Maintenance Period.
  1. This ninety (90) day Maintenance Period shall occur within the specified project completion timeframe.

### 3.06 WORK IN PROGRESS

- A. Contractor shall continuously maintain areas included in the Contract during the progress of the work and until final acceptance of the work.
- B. During Maintenance Period the contractor shall maintain the site and this includes all mowing (at height approved by District), watering, reseeding, mulching, cultivating, spraying, and trimming necessary to bring the planted areas to a healthy growing condition, and any additional work needed to keep the areas neat, edged, and attractive.
  1. This shall be required on a weekly basis.

- C. During the maintenance period, the Contractor, at his own expense, shall

## TREES, PLANTS AND GROUND COVER

### SECTION 32 93 00

Central Valley Continuation High School

DSA Submittal - Feb. 27, 2026

replace any plant indicating weakness or the probability of dying.

- D. All basins around shrubs and trees shall be maintained at a four (4) inch depth throughout progress of the work, unless otherwise instructed by the District's authorized representative.
- E. Tree stakes that for any reason are damaged or rendered inadequate for support shall be repaired and restored to their original condition.
- F. Constant diligence shall be maintained for the advent of disease, insects, and/or rodent infestation, and proper preventative or control measures taken.
- G. All shrubs and trees shall be maintained in their natural shapes.
  - 1. Tall or scraggly branches shall be thinned out where necessary.
  - 2. In no case shall trees or shrubs be trimmed by heading or shearing.
  - 3. Any plants severely pruned in this manner shall be removed and replaced at the Contractor's expense.
- H. Liquid maintenance program to be applied with the installed fertigation unit:
  - 1. Live Earth Liquid 6% - @ 5 gallons per acre per month using the EZ-Flo System, 5 times per year.
  - 2. Live Earth Blitz 22 liquid @ 5 gallons per acre per month using the EZ-Flo System, 3 times per year.
  - 3. Live Earth Iron 10 granular (5-0-0) @ 15lbs per 1000sq ft. December and February applications.
- I. At completion of maintenance period, all areas included in the Contract shall be substantially clean and free of debris.
  - 1. All plant materials shall be alive, healthy, and free of infestations.
- J. The Contractor, at his expense, shall repair any erosions or slippage of soil caused by watering.

### 3.07 CLEAN UP

- A. All walks, curbs, and gutter shall be kept clear of debris, mud, dust, and standing water by sweeping, mopping, or hosing down, as required to maintain cleanliness throughout.

### 3.08 NOTICE

- A. The Contractor, within fourteen (14) days of written notification by the District's authorized representative, shall remove and replace all guaranteed plant materials that for any reason fail to meet the requirements of the guarantee.
  - 1. All plant material replaced shall be guaranteed for the original period, starting from the date of replacement.
- B. Written Notice:

## TREES, PLANTS AND GROUND COVER SECTION 32 93 00

Central Valley Continuation High School  
DSA Submittal - Feb. 27, 2026

1. At the end of the specified Maintenance Period, the Contractor shall present written notice to the District's authorized representative that he has completed the required maintenance, and upon acceptance by District, any further maintenance will be the responsibility of the District.

**END OF SECTION**

## SECTION 33 11 00

### WATER SYSTEM

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Construction of on-site water service facilities and appurtenances, including the installation and testing of water system and services indicated for domestic water services. The Contractor shall furnish and install pressure reducing valves, double check detectors, reduced pressure backflow preventers, blowoffs, air release valves, gate valves and appurtenances, as required.

##### 1.02 REFERENCES

- A. Geotechnical Report:

Geotechnical investigation as been prepared under the direction of the Owner. Investigation is hereby referenced as information for the work of this section. Architect assumes no responsibility for conclusions the Contractor may draw, from information provided. The Contract Documents take precedence over recommendations that may be contained in the investigation and the contractor must obtain approval for any and all deviations from the Contract Documents. Copy of investigation is available at Architect's office. Copy investigation is bound herein as a reference only.

- B. Publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

- 1. Standard Specifications:
  - a. Standard Specifications for Public Works Construction (Latest Edition).
- 2. Standard Drawings:

- C. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM D1785 1999 Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80
- 1. ASTM D2466 2001 (Vinyl Chloride) (PVC) Plastic Pipe Fitting, Schedule 40
- 2. ASTM D2564 1996 Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings
- 3. ASTM D2774 2001 Underground Installation of Thermoplastic Pressure Piping
- 4. ASTM D2855 1996 Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings
- 5. ASTM F402 1999 Safe Handling of Solvent Cements and Primers Used for Joining Thermoplastic Pipe and Fittings

- D. AMERICAN WATER WORKS ASSOCIATION





- B. Handling. Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Carry, do not drag pipe to the trench. Store plastic piping, jointing materials that are not to be installed immediately under cover out of direct sunlight.

## **PART 2 - PRODUCTS**

### **2.01 WATER SERVICE LINE MATERIALS**

#### **A. Piping Materials:**

- 1. Plastic piping and fittings shall bear the seal of the National Sanitation Foundation for potable water service. Plastic pipe and fittings shall be supplied from the same
  - a. Polyvinyl Chloride (PVC) Plastic Piping Less Than Six Inches in Diameter: SDR 14 with Class 200 pressure rating manufactured in accordance with AWWA Standard C900, unless otherwise noted. Rubber waterlock rings shall be supplied by pipe supplier.
  - b. Polyvinyl Chloride (PVC) Plastic Piping Six to Twelve Inches in Diameter: SDR 18 with Class 150 pressure rating manufactured in accordance with AWWA standard C900, unless otherwise noted. Rubber water lock rings shall be supplied by pipe supplier.
- 2. Ductile Iron Piping (DIP): Ductile iron pipe shall be pressure Class 350 with Tyton joints unless otherwise noted on plans and manufactured in accordance with AWWA standard C151. Ductile iron pipe and fitting shall be supplied by the same manufacturer.

#### **B. Valves and Valve Covers:**

- 1. Gate Valves and Butterfly Valves:
  - a. Gate valves, including tapping valves, shall be resilient seat gate valves manufactured in accordance with AWWA standard C509.
  - b. Butterfly valves shall be manufactured in accordance with AWWA Standard C504.
- 2. Gate Valve Covers and Gate Cans:
  - a. All gate valve covers shall be 8 inch diameter cast iron, having the letters S.C.W. Co. and the word "Water" in raised letters on top. Gate material shall be 8 inch I.D. PVC pipe, schedule 40.
- 3. Post Indicator Valves, Double Detector Check Valves, Check Valves and reduced Pressure Backflow Preventers.

#### **C. Precast Meter Boxes and Vaults. Provide as shown on the plans.**

- D. Water Main Appurtenances. All water main appurtenances including, but not limited to fire hydrants, water meters, fire department connections, air and vacuum release valves, tapping sleeves, blow off assemblies, water services, brass fittings and iron fittings shall be as shown on the plans.

## PART 3 - EXECUTION

### 3.01 INSTALLATION OF PIPELINES

- A. The Contractor shall notify Underground Service Alert at 1-800-422-4133 at least two (2) days prior to starting work and shall coordinate all work with utility company representatives. The existence and locations of existing underground facilities indicated on the plans were obtained from a search of available records. The Contractor shall take precautionary measures to protect any existing facility indicated on the plans, and any other which is not of record or indicated on the plans.
- B. Prior to commencing the work, the Contractor shall POTHOLE EXISTING UTILITIES at points of connection.
- C. Contractor shall coordinate locations of stub-outs from buildings with building plumbing Contractor.
- D. Installation of Water Service Piping:
  - 1. Location:
    - a. Connect water service piping to the building service where the building service has been installed. Where building service has not been installed, terminate water service lines approximately 5 feet from the building line at the points indicated; such water service lines shall be closed with plugs or caps.
  - 2. Service Line Connections to Water Mains:
    - a. Domestic Service:
      - 1. The Contractor shall be responsible to install the service lateral, 2" ball valve curb stop with PVC pack joint inlet and outlet per the Governing Water District's standard drawings set in a No. 3 Water meter box with extensions. The Contractor shall be responsible to continue water service piping from the 2" water stop to the building terminus as specified in Paragraph 3.01A. above.
    - b. Fire Sprinkler Service:
      - 1. The Contractor shall be responsible to install fire service piping from the connection at main to the building terminus as specified in Paragraph 3.01A. above, including installation of above-ground double check detector assembly, reduced pressure backflow preventer, post indicator valve, thrust blocks, and calculations, and fire department connection as indicated.
- E. Special Requirements for Installation of Water Service Piping:
  - 1. Installation of Plastic Piping:
    - a. Install pipe and fittings in accordance with Section 306-1.2, 306-1.2.13 of the standard specifications and the applicable requirement of ASTM D2774 and ASTM D2855, unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with ASTM F402.
      - 1. Jointing: Make solvent-cemented joints for PVC plastic piping using the solvent cement previously specified for this material; assemble joints in accordance with ASTM D2855. Make plastic pipe joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer. Make push-on

- joints in accordance with the recommendations of the manufacturer.
2. Plastic Pipe Connections to Appurtenances: Connect plastic pipe service lines to corporation stops and gate valves in accordance with the recommendations of the plastic pipe manufacturer.
- F. Pipe Anchorage:
1. Provide concrete thrust blocks for water mains and fire service laterals.
- G. Trenching and Buried Warning Tape. Perform earthwork operations in accordance with Section 31 23 17, Trenching, including installation of buried warning tape. Install solid copper tracer wire on domestic water lines.
- H. Disinfection. Flush and disinfect all new water lines including reclaimed water lines and affected portions of existing potable water lines in accordance with AWWA C651. Apply chlorine by the continuous feed method.
- 3.02 FIELD QUALITY CONTROL
- A. Field Tests and Inspections:
1. The Contractor shall perform pipeline testing in accordance with Section 306-1.4 of the standard specifications and the Governing Water District's standard specifications.
  2. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with the drawings and specifications.
- B. Testing Procedure:
1. Test water mains and water service lines in accordance with the applicable specified standard. Test PVC plastic water service lines made with PVC plastic water main pipe in accordance with the requirements of UNI B3 for pressure and leakage tests. Test water service lines in accordance with applicable requirements of AWWA C600 for hydrostatic testing. No leakage will be allowed at plastic pipe joints.
- C. Special Testing Requirements:
1. For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system, except that for those portions of the system having pipe size larger than 2 inches in diameter, hydrostatic test pressure shall be not less than 200 psi. Hold this pressure not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

#### **END OF SECTION**

## **SECTION 33 31 00**

### **SANITARY SEWAGE SYSTEMS**

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

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

- A. Sanitary drainage piping, fittings and accessories.
- B. Connection of building sanitary drainage system to site sewer systems.
- C. Cleanout access.
- D. Connection of site sewer system to municipal sewer system unless indicated otherwise on Drawings.
- E. Grease Interceptor

##### **1.02 REFERENCE STANDARDS**

- A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.
- B. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- C. SSPWC - Standard Specifications for Public Works Construction, Latest Edition.
- D. APWA - American Public Works Association.
- E. ANSI / ASTM D3034 – Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

##### **1.03 REGULATORY REQUIREMENTS**

- A. Conform to Section 306, Standard Specifications for Public Works Construction, for materials and installation of Work of this Section.

##### **1.04 SUBMITTALS**

- A. Shop drawings indicating dimensions, locations and elevations of manholes, cleanouts and sub-surface structures.
- B. Product data for pipe and pipe accessories.
- C. Project Record Documents
  1. Accurately record location of pipe runs, connections, manholes, cleanouts and invert elevations.
  2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

## **PART 2 - PRODUCTS**

### **2.01 SEWER PIPE MATERIALS**

- A. Plastic Pipe: ASTM D2751, acrylonitrile-butadiene-styrene (ABS) material; sizes; bell and spigot style solvent sealed end joints.
- B. SDR35 PVC pipe with rubber gasket joints.
- C. Hub and Spigot, Cast-Iron Soil Pipe and Fittings: ASTM A74, Service class, gray cast iron for gasketed joints. Include ASTM C564, rubber compression-type gaskets.

### **2.02 PIPE ACCESSORIES**

- A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene-ribbed gasket for positive seal.
- B. Fittings: Same material as pipe, molded or formed to suit pipe size and end design, in required "T", bends, elbows, cleanouts, reducers, traps and other configurations required.
- C. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D3034, SDR 35, for solvent-cemented or gasketed joints.
  - 1. Gaskets: ASTM F477, Elastomeric seals.

### **2.03 CLEANOUTS**

- A. Lid and Frame: Cast iron construction, removable lid, closed checkerboard grill lid design; nominal lid and frame diameter as required for pipe sizes. (APWA 304-0)
- B. Manholes: American Public Works Association, APWA 321-1.

### **2.04 FILL MATERIAL**

- A. Bedding and Fill: As specified in Section 31 23 17.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that trench cut or excavation base is ready to receive work, excavations, dimensions and elevations are as indicated on Drawings.
- B. Beginning of installation means acceptance of existing conditions.
- C. Verify that existing invert elevations on site will allow proper tie in to new work with proper positive slope. Ascertain accuracy prior to trenching and installation of sanitary sewer system.

### **3.02 PREPARATION**

- A. Hand trim excavations to required elevations. Correct over excavation with approved fill material.
- B. Remove large stones or other hard matter that could damage sewer pipe or impede consistent backfilling or compaction.

### 3.03 INSTALLATION - PIPE

- A. Prior to commencing Work, Contractor shall pothole existing utilities at points of connection. Notify Architect in event of discrepancies.
- B. Install pipe, fittings and accessories in accordance with Section 306, SSPWC and manufacturer's instructions. Seal joints watertight.
- C. Place pipe on bedding as specified in Section 31 23 17.
- D. Lay pipe to slope gradient noted on Drawings with maximum variation from true slope of 1/8 inch in 10 feet.
- E. Begin laying pipe at low point of system with bells facing upstream.
- F. Do not displace or damage pipe when compacting.
- G. Connect to site sewer outlet system through installed sleeves.
- H. Do not cover joints until lines have been tested and approved.

### 3.04 INSTALLATION - CLEANOUTS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Establish elevations and pipe inverts.
- C. Mount lid and frame level in grout secured to top cone section to elevation indicated.

### 3.05 PROTECTION

- A. Protect pipe cover from damage or displacement until backfilling operation is in progress.

**END OF SECTION**

## **SECTION 33 41 00**

### **STORM DRAIN SYSTEMS**

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

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

- A. Storm drainage piping, fittings, and accessories.
- B. Catch basins, paved area drainage, manhole access and site surface drainage.

##### **1.02 REFERENCE STANDARDS**

- A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.
- B. CPC - California Plumbing Code, 2019, Chapter 11.
- C. ASTM A74 - Cast Iron Soil Pipe and Fittings.
- D. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- E. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- F. ANSI/ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- G. ANSI/ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- H. ANSI A21.11 - Rubber Gasket Joints for Cast Iron and Ductile-Iron Pressure Pipe and Fittings.
- I. SSPWC - Standard Specifications for Public Works Construction, Latest Edition.
- J. APWA - American Public Works Association.

##### **1.03 REGULATORY REQUIREMENTS**

- A. Conform to Section 306, SSPWC, code for materials and installation of the Work of this Section.

##### **1.04 SUBMITTALS**

- A. Shop drawings indicating dimensions, locations and elevations of catch basins, manholes, cleanouts and subsurface structures.
- B. Product data indicating pipe and pipe accessories.
- C. Project Record Documents
  - 1. Accurately record location of pipe runs, connections, catch basins, manholes, cleanouts and invert elevations.
  - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS - STORM DRAIN PIPE MATERIALS**

- A. Products of the following manufacturers form the basis for design and quality intended.
  - 1. Cast Iron Pipes
    - a. Precast Products, Garden Grove, CA.
  - 2. Reinforced Concrete Pipes, Manholes, Utility Structures
    - a. Johnson Bateman Co., Ontario, CA.
    - b. Precast Products, Garden Grove, CA.
    - c. Jensen Precast, Fontana, CA.
  - 3. PVC Pipe
    - a. Diamond Plastic Corp., Grand Island, NE.
    - b. Advanced Drainage Systems, Inc., Hilliard, OH.
- B. Or equal as approved in accordance with Division 01, General Requirements for substitutions.

### **2.02 STORM DRAIN PIPE MATERIALS**

- A. Cast Iron Pipe: ASTM A74; service type; plain end joints.
- B. Cast Iron Pipe Joint Device: ANSI A21.11, rubber gasket joint device.
- C. Reinforced Concrete Pipe: ASTM C76, with wall Type B; mesh or bar reinforcement; plain end joints.
- D. Reinforced Concrete Pipe Joint Device: ASTM C443, rubber compression gasket joint.
- E. Plastic Pipe: ASTM D2729, polyvinyl chloride (PVC) material; bell and spigot style solvent sealed end joints.
- F. Plastic Pipe: ASTM D3034, Type PSM, polyvinyl chloride (PVC) material; bell and spigot style rubber gasket joints joints.



## 2.03 PIPE ACCESSORIES

- A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.
- B. Fittings: Same material as pipe, molded or formed to suit pipe size and end design, in required 'T', bends, elbows, cleanouts, reducers, traps, and other configurations required.

## 2.04 CATCH BASINS

- A. Basin Lid and Frame: Welded steel grating construction conforming to ADA spacing requirements, hinged lid, linear grill lid design.
1. Grid/Openings limited to 1/2 – Inch maximum with direction of grate slots perpendicular to path of travel.
- B. Shaft Construction and Cone Top Section: Reinforced precast concrete pipe sections, lipped male/female dry joints.
  - C. Base Pad: Cast-in-place concrete of type specified in Section 03 30 00; leveled top surface to receive concrete shaft sections, sleeved to receive pipe sections.
  - D. Accessories: Joint Sealant for gasketing of concrete sections flexible butyl resin sealant, ASTM C990, Concrete Sealants CS-102 and CS-202 by ConSeal by Concrete Sealants Inc., New Carlisle, Ohio. Or equal.
  - E. Provide catch basin unless otherwise indicated on Drawings.

## 2.05 MANHOLES AND CLEANOUTS

- A. Lid and Frame: Cast iron construction, removable lockable lid, closed lid design; nominal lid and frame diameter of 26 inches; manufactured by Brooks Products, or equal.
- B. Shaft Construction and Cone Top Section: Reinforced precast concrete pipe sections, lipped male/female dry joints; cast steel ladder rungs into shaft sections at 12 inches; nominal shaft diameter of 48 inches; manufactured by Brooks Products, or equal.
- C. Base Pad: Cast-in-place concrete of type specified in Section 32 13 13; leveled top surface to receive concrete

shaft sections, sleeved to receive storm drain pipe sections.

- D. Accessories: Joint Sealant for gasketing of concrete sections flexible butyl resin sealant, ASTM C990, Concrete Sealants CS-102 and CS-202 by ConSeal by Concrete Sealants Inc., New Carlisle, Ohio. Or equal.
- E. Cleanouts: Iron body type; extra heavy bronze plugs; manufactured by Acorn Engineering Co., J.R. Smith Mfg. Co., or F.A. Zurn Mfg. as follows:
  - 1. Concrete areas: non skid nickle bronze lid, set flush with surface; Acorn 120-11, Smith 4240, or Zurn Z-1326-10.
  - 2. Non surface and asphalt surface areas: Non skid extra heavy cast iron cover; Acorn 120-10, Smith 4240, Zurn Z-1326-10.

## 2.06 FILL MATERIAL

- A. Bedding and Fill: Type specified in Section 31 23 17.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify that trench cut or excavation base is ready to receive work.
- B. Verify existing invert elevations for proper tie-in of new work prior to trenching and installation of storm drain system.
- C. Beginning of installation means acceptance of existing conditions.

### 3.02 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with approved fill material.
- B. Remove large stones or other hard matter that could damage drainage pipe or impede consistent backfilling or compaction.

### 3.03 INSTALLATION - PIPE

- A. Install pipe beginning at low point on system.
- B. Install pipe, fittings, and accessories in accordance with Section 306, SSPWC. Seal joints watertight.
- C. Place pipe on bedding as specified in Section 31 23 17.

- D. Lay pipe to slope gradients noted on drawings, with maximum variation for true slope of 1/8 inch in 10 feet.
- E. Install bedding at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches.
- F. Place bedding in maximum 8 inch lifts, consolidating each lift.
- G. Do not displace or damage pipe when compacting.
- H. Connect to storm drain municipal system through installed sleeves. Do not cover joints until lines have been tested and approved.

#### 3.04 INSTALLATION - CATCH BASINS, MANHOLES AND CLEANOUTS

- A. Install per Standard Specifications for Public Works Construction.
- B. Form bottom of excavation clean and smooth to correct elevation.
- C. Form and place cast-in-place concrete base pad, with provision for storm drain pipe end sections.
- D. Establish elevations and pipe inverts for inlets and outlets.
- E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

#### 3.05 FIELD QUALITY CONTROL

- A. Request inspection by Geotechnical Engineer prior to placing cover over pipe.

#### 3.06 PROTECTION

Protect pipe and filter aggregate cover from damage or displacement until backfilling operation is in progress.

**END OF SECTION**