

# PRE-BID CLARIFICATION FORM

PROJECT NAME:		FILLMORE HIGH SCHOOL NEW ATHLETIC COMPLEX	
PROJECT NUMBER:		Project No. 2024-017 / DSA #03-123950	
TO:		<b>RJ Stump</b> EMAIL: <a href="mailto:rj.stump@fillmoreusd.org">rj.stump@fillmoreusd.org</a> <b>Fillmore Unified School Dist.</b>  <b>Roy Frey</b> <b>WestGroup Designs</b> <a href="mailto:royf@westgroupdesigns.com">royf@westgroupdesigns.com</a>	
DATE:	1-23-25		
FROM:	Neil Hulin	EMAIL:	Nhulin@bowecontractors.com
DOCUMENT/DIVISION NUMBER:	Alt #2 Specifications	DRAWING NUMBER:	

## REQUESTED CLARIFICATION:

The base bid and Alt #1 both have their own project manual/specification sections.  
Please provide the project manual/specification sections for Alt#2.

## PRE-BID CLARIFICATION FORM

### RESPONSE TO CLARIFICATION:

Project manual was provided in bid documents. See attached project manual for Alternate #2 - FHS Mod. - Cafeteria, Shade and Library. Note: subsequent DSA approved Addendum 01, 02, and 03 are also part of the bid package.

Roy Frey - Westgroup Designs 01.23.2024

Attach additional numbered sheets as necessary; however, only one (1) request shall be contained on each submitted form.

# PROJECT MANUAL

## FILLMORE HIGH SCHOOL

### MODERNIZATION

DSA #03-121233  
FILE #56-H1

**555 CENTRAL AVENUE**  
FILLMORE, CA 93015

**WD Project # 20624**

## SECTION 00 01 03 - PROJECT DIRECTORY

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Identification of project team members and their contact information.

#### 1.02 OWNER:

- A. Name: Fillmore Unified School District.
  - 1. Address Line 1: 627 Sespe Avenue.
  - 2. City: Fillmore.
  - 3. State: CA.
  - 4. Zip Code: 93015.
  - 5. Telephone: 805-524-6038.
- B. Primary Contact: All correspondence from the Contractor to the Architect will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
  - 1. Title: Assistant Superintendent.
  - 2. Name: Andrea McNeill.
  - 3. Email: amcneill@fillmoreusd.org.

#### 1.03 CONSULTANTS:

- A. Architect: Design Professional of Record. All correspondence from the Contractor regarding construction documents authored by Architect's consultants will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
  - 1. Company Name: Westgroup Designs.
    - a. Address Line 1: 19520 Jamboree Road.
    - b. Address Line 2: Suite 100.
    - c. City: Irvine.
    - d. State: CA.
    - e. Zip Code: 92612.
    - f. Telephone: 949-250-0880.
  - 2. Primary Contact: .
    - a. Title: Project Manager.
    - b. Name: Joshua Smith.
    - c. Email: JoshuaS@westgroupdesigns.com.
- B. Civil/Structural Engineering Consultant:
  - 1. Company Name: Coast Engineering.
    - a. Address Line 1: 10231 Slater Avenue.
    - b. Address Line 2: Suite 201.
    - c. City: Fountain Valley.
    - d. State: CA.
    - e. Zip Code: 92708.
    - f. Telephone: 714-593-0337.
  - 2. Primary Contact: .
    - a. Title: Principal.
    - b. Name: Farhad Rezai.
    - c. Email: farhad@coastengr.com.
- C. Mechanical Engineering Consultant:
  - 1. Company Name: Pezeshki Engineering, Inc..
    - a. Address Line 1: 1920 E. Warner Avenue.
    - b. Address Line 2: Suite 3H.
    - c. City: Santa Ana.
    - d. State: CA.
    - e. Zip Code: 92705.
    - f. Telephone: 714-884-3803.



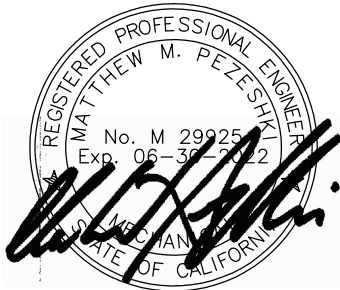
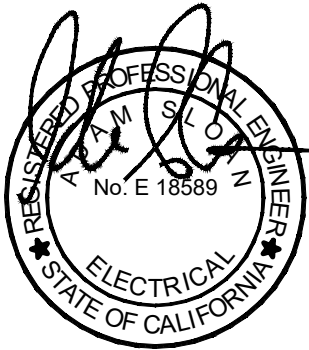
- 2. Primary Contact: .
  - a. Title: Principal.
  - b. Name: Matthew Pezeshki.
  - c. Email: mpezeshki@pei-eng.com.
- D. Electrical Engineering Consultant:
  - 1. Company Name: AG Design.
    - a. Address Line 1: 171 S. Anita Drive.
    - b. Address Line 2: Suite 111.
    - c. City: Orange.
    - d. State: CA.
    - e. Zip Code: 92868.
    - f. Telephone: 714-769-9900.
  - 2. Primary Contact: .
    - a. Title: Principal.
    - b. Name: Adam Sloan.
    - c. Email: asloan@agdesigneng.com.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

SECTION 00 01 07 - SEALS PAGE



END OF SECTION

IDENTIFICATION STAMP  
DIV. OF THE STATE ARCHITECT

APP: 03-121233 INC:

REVIEWED FOR

SS ☒ FLS ☒ ACS ☒

DATE: 04/20/2022

## **SECTION 00 01 10 - TABLE OF CONTENTS**

### **PROCUREMENT AND CONTRACTING REQUIREMENTS**

#### **DIVISION 00 -- PROCUREMENT AND CONTRACTING REQUIREMENTS**

- A. 00 01 01 - Project Title Page
- B. 00 01 03 - Project Directory
- C. 00 01 07 - Seals Page
- D. 00 01 10 - Table of Contents
- E. 00 63 25 - Substitution Request Form - During Construction

### **SPECIFICATIONS**

#### **DIVISION 01 -- GENERAL REQUIREMENTS**

- A. 01 10 00 - Summary
- B. 01 25 00 - Substitution Procedures
- C. 01 41 00 – Regulatory Requirements
- D. 01 42 00 – Reference Standards
- E. 01 45 00 – Quality Control
- F. 01 50 00 - Temporary Facilities and Controls
- G. 01 60 00 - Product Requirements
- H. 01 70 00 - Execution and Closeout Requirements

#### **DIVISION 02 -- EXISTING CONDITIONS**

- A. 02 41 00 – Demolition
- B. 02 77 00 – Site Concrete Work

#### **DIVISION 03 -- CONCRETE**

- A. 03 20 00 – Concrete Reinforcement
- A. 03 30 00 - Cast-in-Place Concrete
- B. 03 31 00 – Slab On Grade Concrete

#### **DIVISION 04 -- MASONRY**

- A. 04 20 00 - Unit Masonry

#### **DIVISION 05 -- METALS**

- A. 05 12 00 - Structural Steel Framing
- B. 05 12 13 - Architecturally-Exposed Structural Steel Framing
- C. 05 50 00 – Metal Fabrications
- D. 05 52 13 - Pipe and Tube Railings

#### **DIVISION 06 -- WOOD, PLASTICS, AND COMPOSITES**

- A. 06 10 00 - Rough Carpentry
- B. 06 41 00 - Architectural Wood Casework
- C. 06 42 00 - Wood Paneling

#### **DIVISION 07 -- THERMAL AND MOISTURE PROTECTION**

- A. 07 21 00 - Thermal Insulation
- B. 07 25 00 - Weather Barriers

- C. 07 51 00 - Built-Up Bituminous Roofing
- D. 07 62 00 - Sheet Metal Flashing and Trim
- E. 07 72 00 - Roof Accessories
- F. 07 92 00 - Joint Sealants

#### **DIVISION 08 -- OPENINGS**

- A. 08 11 13 - Hollow Metal Doors and Frames
- B. 08 14 16 - Flush Wood Doors
- C. 08 31 00 - Access Doors and Panels
- D. 08 33 13 - Coiling Counter Doors
- E. 08 36 13 - Sectional Doors
- F. 08 43 13 - Aluminum-Framed Storefronts
- G. 08 71 00 - Door Hardware
- H. 08 80 00 - Glazing
- I. 08 83 00 - Mirrors

#### **DIVISION 09 -- FINISHES**

- A. 09 05 61 - Common Work Results for Flooring Preparation
- B. 09 21 16 - Gypsum Board Assemblies
- C. 09 22 36 - Lath
- D. 09 24 00 - Cement Plastering
- E. 09 30 00 - Tiling
- F. 09 51 00 - Acoustical Ceilings
- G. 09 65 00 - Resilient Flooring
- H. 09 68 13 - Tile Carpeting
- I. 09 91 13 - Exterior Painting
- J. 09 91 23 - Interior Painting

#### **DIVISION 10 -- SPECIALTIES**

- A. 10 28 00 - Toilet, Bath, and Laundry Accessories
- B. 10 44 00 - Signage

#### **DIVISION 11 -- EQUIPMENT**

Not Used

#### **DIVISION 12 -- FURNISHINGS**

- A. 12 36 00 - Countertops

#### **DIVISION 13 -- SPECIAL CONSTRUCTION**

- A. 13 31 00 - Fabric Structures

#### **DIVISION 14 -- CONVEYING EQUIPMENT**

Not Used

#### **DIVISION 21 -- FIRE SUPPRESSION**

Not Used

#### **DIVISION 22 -- PLUMBING**

- A. 22 05 00 - Common Work Results For Plumbing
- B. 22 05 03 - Earthwork For Plumbing Systems
- C. 22 05 11 - Supplementary Plumbing Requirements

- D. 22 05 12 – Plumbing Product Substitutions
- E. 22 05 14 – Selective Plumbing Demolition
- F. 22 05 15 – Access Doors and Panels
- G. 22 05 23 – General Duty Valves For Plumbing Piping
- H. 22 05 29 – Supports and Anchors
- I. 22 05 53 – Plumbing Identification
- J. 22 07 00 – Plumbing Insultation
- K. 22 10 00 – Plumbing Piping
- L. 22 11 16 – Water Distribution Piping (Inside Building)
- M. 22 11 19 – Piping Specialties
- N. 22 13 16 – Sanitary Waste and Vent Piping
- O. 22 42 00 – Commercial Plumbing Fixtures

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

- A. 23 05 00 – Common Work Results For HVAC
- B. 23 05 11 – Supplementary HVAC Requirements
- C. 23 05 12 – HVAC Product Substitutions
- D. 23 05 13 – Common Motor Requirements For HVAC Equipment
- E. 23 05 14 – Selective HVAC Demolition
- F. 23 05 15 – Access Doors And Panels
- G. 23 05 29 – Supports and Anchors
- H. 23 05 48 – Vibration Control For HVAC
- I. 23 05 53 – HVAC Identification
- J. 23 05 99 – Testing Adjusting And Balancing
- K. 23 07 00 – HVAC Insulation
- L. 23 31 13 – Metal Ductwork
- M. 23 33 00 – Ductwork Accessories
- N. 23 34 23 – Power and Gravity Ventilators
- O. 23 37 13 – Air Outlets and Inlets
- P. 23 74 13 – Packaged Rooftop Heat Pumps

#### **DIVISION 25 -- INTEGRATED AUTOMATION**

Not Used

#### **DIVISION 26 -- ELECTRICAL**

- A. 26 00 00 – General Electrical Requirements
- B. 26 01 70 – Grounding and Bonding
- C. 26 01 90 – Supporting Devices
- D. 26 01 95 – Electrical Identification
- E. 26 05 19 – Low Voltage Electrical Power Conductors and Cables
- F. 26 05 33 – Raceway and Boxes for Electrical Systems
- G. 26 09 23 – Network Lighting Controls
- H. 26 22 00 – Low Volatage Transformers
- I. 26 24 16 – Panelboards
- J. 26 51 00 – Interior Lighting Fixtures

**DIVISION 27 – COMMUNICATIONS**

- A. 27 51 26 – Assistive Listening System
- B. 27 60 00 – Pavement Marking

**DIVISION 28 -- ELECTRONIC SAFETY AND SECURITY**

- A. 28 00 00 – Fire Alarm System

**DIVISION 31 – EARTHWORK**

- A. 31 22 00 – Grading
- B. 31 23 00 – Excavation, Backfilling, and Compaction
- C. 31 23 17 – Excavation, Backfilling, and Compaction for Pavement
- D. 31 23 17 – Excavation, Backfilling, and Compaction for Structural

**DIVISION 32 -- EXTERIOR IMPROVEMENTS**

- A. 32 10 00 – Pavement Repair
- B. 32 11 23 – Base Course
- C. 32 12 16 – Asphalt Concrete Paving
- D. 32 12 18 – Site Concrete Paving Reinforcement
- E. 32 24 00 – Environmental Import and Export Materials Testing

**DIVISION 33 – UTILITIES**

- A. 33 14 16 – Site Water Distribution Systems
- B. 33 31 13 – Sanitary Sewage Systems
- C. 33 40 00 – Storm Drainage System

**DIVISION 46 -- WATER AND WASTEWATER EQUIPMENT**

Not Used

**END OF SECTION**

SECTION 00 63 25 - SUBSTITUTION REQUEST FORM - DURING CONSTRUCTION



Your Partner in Your Vision

SUBSTITUTION REQUEST FORM

TO:

PROJECT:

SPECIFIED ITEM: \_\_\_\_\_  
Section Page Paragraph Description

The contractor requests consideration of the following:

REQUESTED SUBSTITUTION:

\_\_\_\_\_  
\_\_\_\_\_

PROPOSED CHANGE IN CONTRACT SUM: Deduct the sum of \_\_\_\_\_

*Attached data includes product description, specifications, drawings, photographs, performance, and test adequate for evaluation of the requests; applicable portions of the data are clearly identified.*

*Attached data also includes description of changes to Contract Documents which proposed substitution will require for proper installation.*

The Contractor states that the following paragraphs are correct:

1. The proposed substitution does not affect dimensions shown on Drawings.
2. The Contractor will pay for changes to the design of Project, including engineering design, detailing, and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse affect on other work, directly related or otherwise, the construction schedule, or specified warranty requirements.
4. Maintenance and service parts will be locally available for the proposed situation.

The Contractor further states that the function, appearance, and quality of the proposed substitutions are equivalent or superior to the specified item.

SUBMITTED BY CONTRACTOR:

Signature: \_\_\_\_\_

Firm: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_

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

Attachments:

FOR USE BY ARCHITECT:

☐ Accepted ☐ Accepted as Noted  
☐ Not Accepted ☐ Received Too Late

Remarks: \_\_\_\_\_

Owner: \_\_\_\_\_

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

END OF SECTION

## **SECTION 01 10 00 - SUMMARY**

### **PART 1 GENERAL**

#### **1.01 PROJECT**

- A. Project Name: Fillmore HS Moderization
- B. Owner's Name: Fillmore Unified School District.
- C. Architect's Name: Westgroup Designs.
- D. The Project consists of the construction of pre-approved shade structures, interior modifications to cafeteria and library, modifications to exterior glazing and doors, new hardscape, new exterior concrete stairs.

#### **1.02 CONTRACT DESCRIPTION**

#### **1.03 DESCRIPTION OF ALTERATIONS WORK**

- A. Scope of alterations work is indicated on drawings.

#### **1.04 OWNER OCCUPANCY**

- A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
- B. Owner intends to occupy the Project upon Substantial Completion.
- C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- D. Schedule the Work to accommodate Owner occupancy.

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

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

**END OF SECTION**



## **SECTION 01 25 00 - SUBSTITUTION PROCEDURES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Procedural requirements for proposed substitutions.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 00 63 25 - Substitution Request Form - During Construction: Required form for substitution requests made after award of contract (During construction).

#### **1.03 DEFINITIONS**

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.

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

### **PART 3 EXECUTION**

#### **3.01 GENERAL REQUIREMENTS**

- A. A Substitution Request for products, assemblies, materials, and equipment 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, equipment, assembly, or system.
  - 2. Agrees to provide the same warranty for the substitution as for the specified product.
  - 3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension that may subsequently become apparent.
  - 5. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
- D. Limit each request to a single proposed substitution item.

#### **3.02 SUBSTITUTION PROCEDURES DURING CONSTRUCTION**

- A. Submittal Form (after award of contract):
  - 1. Submit substitution requests by completing the form in Section 00 63 25; see this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- B. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- C. Substitutions will not be considered under one or more of the following circumstances:
  - 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
  - 2. Without a separate written request.

#### **3.03 RESOLUTION**

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.
  - 1. Architect's decision following review of proposed substitution will be noted on the submitted form.

### **3.04 ACCEPTANCE**

- A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

**END OF SECTION**

## **SECTION 01 41 00**

### **REGULATORY REQUIREMENTS**

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

1.01 DESCRIPTION: Division 1 and this Section covers general requirements for codes and standards pertaining to the Work and is supplementary to the codes and standards mentioned or referenced elsewhere in the Contract Documents.

1.02 CODES AND STANDARDS:

**A. Requirements of Regulatory Agencies:** All pertaining statutes, ordinances, laws, rules, codes, regulations, standards, and lawful orders of public authorities having jurisdiction of the Work of this Contract are hereby incorporated into the Contract Documents the same as if repeated in full herein and are intended wherever reference is made in either the singular or plural to Code or Building Code except as otherwise specified, including, but not limited to, those in the following listing. Contractor shall make available at the site such copies of the listed documents applicable to the Work as Architect or Owner may request, including mentioned portions of the California Code of Regulations (CCR).

1. 2019 California Building Code and Code of jurisdiction including any amended requirements by the City of Fountain Valley Building Department approvals for materials, equipment, systems, and designs as applicable to the Work.
2. Title 8 CCR, Industrial Relations, including Chapter 4, Div. of Industrial Safety, Safety Orders (CAL/OSHA).
3. Title 19 CCR, Public Safety.
4. Title 22 CCR, Social Security.
5. 2019 CBC Title 24, Building Standards, including ADA regulations, architectural barrier laws and regulations regarding disabled persons.
6. 2019 California Green Building Standards Code, Title 24, Building Standards, including ADA regulations, architectural barrier laws and regulations regarding disabled persons.
7. 2019 CMC and Local Mechanical Codes.
8. 2019 CPC and Local Plumbing Codes.
9. Local and State Elevator Codes.
10. 2019 CEC and Local Electrical Codes.
11. 2019 CFC and Current Edition of National Fire Protection Association.
12. State and Local Public Health Codes.
13. (SSPWC) Standard Specifications for Public Works Construction, Current Edition.
14. All other laws, regulations, rules, orders, codes, and ordinances specified in other Sections of these Specifications or bearing on the Work.

END OF SECTION

**SECTION 01 42 00**

**REFERENCE STANDARDS**

**PART 1 - GENERAL**

- 1.01 DESCRIPTION: This Section covers the general requirements for reference standards pertaining to the Work and is supplementary to the reference standards mentioned or referenced elsewhere in the Contract Documents.
- 1.02 REFERENCE AND STANDARD TYPE SPECIFICATIONS: Specifying by reference to reference and standard type specification documents or to another portion of the Contract Documents shall be the same as if the referenced document or portion referred to were exactly repeated at the place where reference is made. In case of conflict between the requirements of regulatory agencies and the referenced reference and standard type specification documents, Contractor shall conform to the most restrictive requirement if such conformance is legal. The reference or standard type specification documents shall be the current issue at the time the Construction Documents Phase, unless otherwise specified. Contractor shall make available at the site such copies of the reference or standard type specification documents as Architect or Owner may request.

END OF SECTION

## **SECTION 01 45 00**

### **QUALITY CONTROL**

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

- 1.01 **DESCRIPTION:** This Section covers general requirements for quality control of the Work, including testing and inspection procedures.

**A. Requirements In This Section:**

1. Testing laboratory or agency.
2. Geotechnical (Soils or Foundation) Engineer.
3. Coordination of tests and inspections.
4. Test costs and reports.
5. Inspections, continuous and special.
6. Contractor-furnished assistance.
7. Verification of conditions.

**B. Requirements Not In This Section:**

1. Specific test procedures to be performed in accordance with this Section.
2. Testing of mechanical and electrical work.
3. Testing of conveying systems.
4. Testing of materials specified to be tested by other agencies under other Section.

- 1.02 **GENERAL QUALITY CONTROL REQUIREMENTS:**

- A. General Test Requirements:** Materials to be furnished under the Contract are subject to testing and inspection for compliance with requirements of Drawings and Specifications.
- B. Testing Laboratory or Agency** shall be the licensed Testing Laboratory or Agency certified as meeting the requirements of ASTM D3666, D3740, E329, E543, and E548 as applicable to the Work employed and paid for by the Owner, and referred to hereafter as the Testing Laboratory. Perform all testing under supervision and control of a California registered professional engineer employed by Testing Laboratory.
- C. Soils or Foundation Engineer** will be the registered professional Geotechnical Engineer employed and paid by Owner.
- D. Disqualified Material:** Any material shipped or delivered to the site by the Contractor from the source of supply prior to having satisfactorily passed the required testing and inspection, or prior to the receipt of a notice from the Architect/IOR that such testing and inspection will not be required, shall not be incorporated in the Work.

- 1.03 **COORDINATION OF TESTS AND INSPECTIONS:** Contractor shall initiate and coordinate testing and inspections required by Contract Documents and public authorities having jurisdiction of the Work.

- A. Notification:** Contractor shall notify the Owner/IOR a sufficient time in advance of the manufacture of material to be supplied by him which, by requirements of the Contract Documents, must be tested at the source of supply in order that the Owner may arrange for the testing.

- 1.04 **TEST SAMPLES AND PROCEDURES:**

- A. Test Samples:** Furnish and deliver Samples of materials to be tested at no extra cost to Owner. Test samples will be selected by the Architect, Inspector, or Testing Laboratory and not by the

Contractor.

- B. Test Procedures:** Testing Laboratory shall perform tests according to ASTM or other methods of test specified for the various materials under other Sections. If no procedure or test method is specified, testing shall conform to material specification referenced unless otherwise directed by Architect/IOR. The Testing Laboratory shall tag, seal, label, record, or otherwise suitably identify the materials for testing and no such materials shall be used in the Work until the test result reports are submitted and approved, excepting only the materials specified to be placed or installed prior to testing. DSA shall have jurisdiction of testing approvals.
- C. Test Repeating:** Repeat applicable tests at specified intervals, whenever the source of supply is changed, or whenever the characteristics of the materials change or vary in the opinion of Owner or Architect.

1.05 **TEST COSTS:** Owner will pay for testing performed by Testing Laboratory except Contractor shall reimburse the Owner for retesting costs caused by failure of materials to pass initial tests. Contractor shall arrange and pay for all other testing.

1.06 **TEST REPORTS:** Furnish copies of each test result report, signed and certified by the Testing Laboratory supervising engineer, as follows:

	Copies
Owner	1
Architect	1
Structural Engineer (structural test only)	1
Contractor	2
DSA Inspector of Record (IOR)	1

1.07 **INSPECTIONS, CONTINUOUS AND SPECIAL:**

- A. Inspections,** continuous and special, shall be performed by RC Inspector(s) or Special Inspectors (hereinafter referred to as the Inspector) as required by the Contract Documents and Building Code. During course of Work under inspection, each Special Inspector shall submit detailed reports relative to progress and condition of Work including variances from the Contract Documents, and stipulating dates, hours, and locations of the inspections.
- B. Inspection Costs:** Owner will employ Inspector and pay for required continuous and special inspections.
- C. Owner's Inspector:** Owner will furnish inspection of the Work at no cost to the Contractor except as otherwise provided herein and except for those inspections required to be furnished and costs paid for by the Contractor elsewhere in the Contract Documents. Perform and construct all Work under inspection of Owner's Inspector unless waived in writing by the Design Professional and/or IOR in each case or exempted wholly or in part from inspection elsewhere in the Contract Documents. Any Work requiring such inspection that is performed or constructed in the absence of the Owner's Inspector is considered defective and is subject to rejection. The Contractor shall give written notice to the Owner at least two working days in advance of the performance of any part of the Work requiring special inspection by someone other than the Owner's Inspector and shall state the probable duration of the required special inspection. The inspection of any material or equipment at the factory or shop will not constitute an acceptance. The Owner's Inspector is authorized to suspend any part or all of the Work, by notice to the Contractor confirmed in writing, whenever a question arises as to whether the materials or equipment being installed or methods or workmanship being used comply with the Contract Documents until such question is decided upon by the Design Professional and/or IOR. The Owner's Inspector is not authorized to accept or reject any Work, to modify any Contract Document requirement, to advise or instruct Contractor or his employees as to prosecution of the Work, or to perform any duty or

service for the Contractor. Inspection of the Work will not relieve Contractor of the obligation to fulfill all requirements of the Contract Documents.

**D. Reimbursement of Inspection Costs:** The Contractor shall reimburse to the Owner all or any part, as the Owner may deem just and proper, of the actual excessive inspection costs incurred by the Owner due to any or all of the following:

1. Contractor's failure to complete the Work within the Contract Time stated in the Agreement, and any previously authorized extensions thereof.
2. Claims between separate contractors.
3. Covering of any of the Work before the required inspections or tests are performed.
4. Extra inspections required for Contractor's correction of defective Work.
5. Overtime costs for acceleration of Work done for Contractor's convenience.

**E. Approvals Required by Others:** If the laws, ordinances, rules, regulations, or orders of any public agency having jurisdiction require any of the Work to be specifically inspected, tested, or approved by some authority other than the Owner, Architect, or Contractor, the Contractor shall give all required notices and make all arrangements, shall deliver to the Architect the certificates of inspection, testing, or approval of such public agency, and shall pay all costs therefor unless otherwise provided in the Contract Documents.

1.08 **CONTRACTOR-FURNISHED ASSISTANCE:** Whenever requested, Contractor shall furnish access, facilities, and labor assistance as necessary for duties to be performed at the site by Testing Laboratory and Inspector including furnishing ladders, hoisting, temporary lighting and water supply, and like services.

1.09 **VERIFICATION OF CONDITIONS:** Prior to installation of any portion of the Work, the installing Contractor, Subcontractor, or Sub-subcontractor shall inspect the Work in place to receive the Work to be installed and arrange for correction of defects in the existing workmanship, material, or conditions that may adversely affect Work to be installed. Such inspections shall include test applications of the materials to be installed as required to establish the correct condition of surfaces involved. Installation of materials on Work in place constitutes acceptance by the installing Contractor, Subcontractor, or Sub-subcontractor of such Work in place as being in proper condition to receive the materials to be applied and waiver of claim that the Work in place is defective as pertains to warranty requirements, excluding unascertainable or concealed conditions. Where the Specifications require a material to be installed under the supervision or inspection of the material manufacturer or his representative, manufacturer or his representative also shall inspect the Work in place and issue a letter of approval to Architect.

## **PART 2 - PRODUCTS** (Not Applicable)

## **PART 3 - EXECUTION**

3.01 **TESTS AND INSPECTIONS:** Owner will pay for the following testing and inspections except as stated otherwise for specific items.

**A. Site Work:** Tests and inspections performed by Geotechnical Engineer of record for the Foundation Investigation Report.

1. Foundations, compaction, and fill and backfill inspection and testing.
2. Shoring of cut banks and slope at cuts, except as otherwise specified under Division 2.
3. Approval of site and imported earthwork materials.
4. Verification of shoring stability and monitoring.

**B. Reinforcing Steel:**

1. Conformance testing of bars - costs paid by Owner.
2. Inspector for welding of bars.

3. Inspector during placement of bars.

**C. Cast-In-Place Concrete:**

1. Mix design of concrete - costs paid by Owner.
2. Conformance testing of materials - costs paid by Owner.
3. Casting and testing of cylinders.
4. Inspector during placing of concrete.

**D. Masonry:**

1. Conformance testing of materials - costs paid by Owner.
2. Testing of mortar and grout.
3. Continuous inspection required by Drawings or Specifications.

**E. Structural Steel:**

1. Conformance testing of materials - costs paid by Owner.
2. Inspector for high-strength bolting, groove welding, and field welding.
3. Inspector for shop fabrication of structural steel unless shop is approved by the Building Department - costs paid by Owner.
4. Inspector to verify grouting under column base plates.
5. Ultrasonic inspection of groove welds and lamination check of materials.

**F. Metal Decking:**

1. Inspector for welding.
2. Inspector for shear stud installation.

END OF SECTION



## **SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Temporary Controls: Barriers, enclosures, and fencing.
- B. Security requirements.
- C. Waste removal facilities and services.

#### **1.02 BARRIERS**

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

#### **1.03 FENCING**

- A. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

#### **1.04 INTERIOR ENCLOSURES**

- A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

#### **1.05 SECURITY - SEE SECTION 01 35 53**

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

#### **1.06 WASTE REMOVAL**

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

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

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

**END OF SECTION**

## **SECTION 01 60 00 - PRODUCT REQUIREMENTS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 25 00 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

#### **1.03 SUBMITTALS**

- A. 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.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
  - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

### **PART 2 PRODUCTS**

#### **2.01 EXISTING PRODUCTS**

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.
- B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.
- C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

#### **2.02 NEW PRODUCTS**

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
- C. Where other criteria are met, Contractor shall give preference to products that:
  - 1. If used on interior, have lower emissions, as defined in Section 01 61 16.
  - 2. If wet-applied, have lower VOC content, as defined in Section 01 61 16.

#### **2.03 PRODUCT OPTIONS**

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

## **PART 3 EXECUTION**

### **3.01 SUBSTITUTION LIMITATIONS**

- A. See Section 01 25 00 - Substitution Procedures.

### **3.02 TRANSPORTATION AND HANDLING**

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

### **3.03 STORAGE AND PROTECTION**

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

**END OF SECTION**

## **SECTION 01 70 00 - EXECUTION AND CLOSEOUT REQUIREMENTS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Cutting and patching.
- C. Surveying for laying out the work.
- D. Cleaning and protection.
- E. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

#### **1.02 QUALIFICATIONS**

- A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

#### **1.03 PROJECT CONDITIONS**

- A. Use of explosives is not permitted.
- B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
- G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
- H. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

#### **1.04 COORDINATION**

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.

- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

## **PART 2 PRODUCTS**

### **2.01 PATCHING MATERIALS**

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

### **3.02 PREPARATION**

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

### **3.03 LAYING OUT THE WORK**

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- F. Utilize recognized engineering survey practices.
- G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
  - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations; and \_\_\_\_\_.
  - 2. Grid or axis for structures.
  - 3. Building foundation, column locations, ground floor elevations, and \_\_\_\_\_.

- H. Periodically verify layouts by same means.
- I. Maintain a complete and accurate log of control and survey work as it progresses.

### **3.04 GENERAL INSTALLATION REQUIREMENTS**

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

### **3.05 CUTTING AND PATCHING**

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. Perform whatever cutting and patching is necessary to:
  - 1. Complete the work.
  - 2. Fit products together to integrate with other work.
  - 3. Provide openings for penetration of mechanical, electrical, and other services.
  - 4. Match work that has been cut to adjacent work.
  - 5. Repair areas adjacent to cuts to required condition.
  - 6. Repair new work damaged by subsequent work.
  - 7. Remove samples of installed work for testing when requested.
  - 8. Remove and replace defective and non-complying work.
- C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- F. Restore work with new products in accordance with requirements of Contract Documents.
- G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.
- I. Patching:
  - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
  - 2. Match color, texture, and appearance.
  - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

### **3.06 PROGRESS CLEANING**

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

### **3.07 PROTECTION OF INSTALLED WORK**

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

### **3.08 ADJUSTING**

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

### **3.09 FINAL CLEANING**

- A. Use cleaning materials that are nonhazardous.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and \_\_\_\_\_.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

### **3.10 CLOSEOUT PROCEDURES**

- A. Make submittals that are required by governing or other authorities.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

- G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

**END OF SECTION**



## **SECTION 02 41 00 - DEMOLITION**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Selective demolition of built site elements.
- B. Selective demolition of building elements for alteration purposes.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- B. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

#### **1.03 SUBMITTALS**

- A. Site Plan: Showing:
  - 1. Areas for temporary construction and field offices.
- B. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
  - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
  - 2. Identify demolition firm and submit qualifications.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

### **PART 2 PRODUCTS**

### **PART 3 EXECUTION**

#### **3.01 GENERAL PROCEDURES AND PROJECT CONDITIONS**

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
  - 3. Provide, erect, and maintain temporary barriers and security devices.
  - 4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
  - 5. Do not close or obstruct roadways or sidewalks without permit.
  - 6. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
  - 7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements that are not to be removed.
  - 1. Provide bracing and shoring.
  - 2. Prevent movement or settlement of adjacent structures.
  - 3. Stop work immediately if adjacent structures appear to be in danger.
- D. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- E. Perform demolition in a manner that maximizes salvage and recycling of materials.
  - 1. Dismantle existing construction and separate materials.

2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

### **3.02 EXISTING UTILITIES**

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

### **3.03 SELECTIVE DEMOLITION FOR ALTERATIONS**

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
  1. Verify that construction and utility arrangements are as indicated.
  2. Report discrepancies to Architect before disturbing existing installation.
  3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Remove existing work as indicated and as required to accomplish new work.
  1. Remove items indicated on drawings.
- C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
  1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
  2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
  3. Verify that abandoned services serve only abandoned facilities before removal.
  4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- D. Protect existing work to remain.
  1. Prevent movement of structure; provide shoring and bracing if necessary.
  2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
  3. Repair adjacent construction and finishes damaged during removal work.
  4. Patch as specified for patching new work.

### **3.04 DEBRIS AND WASTE REMOVAL**

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

**END OF SECTION**

**Section 02770**  
**SITE CONCRETE WORK**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Provisions of Division 01 apply to this section.
- B. Section Includes:
  - 1. Portland cement concrete pavement, cement walks, curbs, gutters, trash pick-up area, ramps, mowing strips, fence post footings, sliding gate concrete tracks, catch basins, pipe bedding and encasements, thrust blocks, transition structures, flagpoles and light standard bases and footings, athletic equipment footings and equipment pads.
- C. Related Sections:
  - 1. Section 02310: Grading.
  - 2. Section 02315: Excavating, Backfilling and Compacting.
  - 3. Section 02316: Excavating, Backfilling and Compacting for Pavement.
  - 4. Section 02319: Base Course.
  - 5. Section 02510: Site Water Distribution Systems.
  - 6. Section 02530: Site Sanitary Sewer Systems.
  - 7. Section 02630: Storm Drainage Systems.
  - 8. Section 02765: Pavement Repair.
  - 9. Section 02821: Chain Link Fences and Gates.
  - 10. Section 03200: Concrete Reinforcement.
  - 11. Division 15: Mechanical.
  - 12. Division 16: Electrical.

**1.2 SUBMITTALS**

- A. Shop Drawings: Submit plans, elevations and details of concrete site Work.
- B. Product Data: Submit mix designs and manufacturer's technical data for materials and products. Submit 3" x 3" concrete Sample of each specified color.

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**SITE CONCRETE WORK**

- C. Material Sample: Submit one concrete bumper to the PI for destructive testing.

**1.3 QUALITY ASSURANCE**

- A. Comply with Standard Specifications For Public Works Construction.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Concrete, Mortar and Related Materials: Comply with applicable provisions of Standard Specifications for Public Works Construction, Section 201 - Concrete, Mortar and Related Materials:
1. Concrete: 28-day compressive strength 2,500 psi, unless specified otherwise.
  2. Reinforcing Mesh: ASTM A 185, 4x4/W1.4 x W1.4 welded wire mesh.
  3. Expansion Joint Filler: Preformed expansion joint filler, bituminous type, complying with ASTM D 994.
- B. Form Materials:
1. Side forms: Douglas fir, Construction Grade or Better or metal forms.
  2. Stakes: Douglas fir, Construction Grade or Better or metal stakes.
- C. Concrete Parking Bumpers:
1. Precast concrete, smooth and free of pits and rock pockets, providing a minimum 28-day compressive strength of 3,500 psi. Size at least 7-1/2 inches wide, 5-1/2 inches high and 6 feet long. Reinforce with 2 #5 reinforcing bars. Provide 2-3/4 inch diameter pre-drilled holes for anchor installation.
  2. Bumper Anchors: Provide 1/2-inch diameter x 18-inch long galvanized steel pipe.
  3. Bumper Adhesive: Provide adhesive recommended by bumper manufacturer/installer for fastening bumpers to concrete pavement.

**PART 3 - EXECUTION**

**3.1 CONSTRUCTION OF FORMS FOR CAST-IN-PLACE STRUCTURES**

- A. Concrete Pavement: Install Portland cement concrete pavement in compliance with the Standard Specifications for Public Works Construction, Section 302-Roadway Surfacing.

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**SITE CONCRETE WORK**

- B. Miscellaneous Exposed Concrete: Install concrete curbs, walks, gutters, cross gutters, access ramps, driveways, catch basins, yard boxes, vaults and similar structures, in compliance with the Standard Specifications for Public Works Construction, Section 303 - Concrete and Masonry Construction.
- C. Exposed Concrete Bases: Install bases, such as for post, flagpole, light standards and similar bases, in compliance with the Standard Specifications for Public Works Construction, Section 303 - Concrete and Masonry Construction.
- D. Post, flagpole, light standard footings below grade, underground conduit bedding, encasements, thrust blocks and similar structures may be placed \directly in excavations conforming to the required sizes.
- E. Reinforcement installation and concrete placement, surface finishes, curing and removal of forms shall be performed in compliance with applicable provisions of Standard Specifications for Public Works Construction, Section 303 - Concrete and Masonry Construction. Provide heavy broom finish at slopes exceeding six (6) percent and medium broom finish at slopes up to six (6) percent.

**3.02            INSTALLATION OF PARKING BUMPERS**

- A. Install bumpers as indicated on the Drawings. On bituminous paving, install anchors through pavement and into the ground a minimum of 12 inches. On concrete pavement, install bumpers in a continuous bed of adhesive.

**3.03            CLEAN UP**

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

**3.04            PROTECTION**

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

**END OF SECTION**

## **SECTION 03200 CONCRETE REINFORCEMENT**

### **Part 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A.** Reinforcing steel bars and accessories for cast-in-place concrete.
- B.** Related Sections:
  - 1. Section 01420: Testing and Inspection.
  - 2. Section 03100: Concrete Formwork.
  - 3. Section 03300: Cast-In-Place Concrete.
  - 4. Section 04210: Brick Masonry
  - 5. Section 04820: Concrete Unit Masonry

#### **1.2 REFERENCES**

- A.** ACI 315 - Details and Detailing of Concrete Reinforcing.
- B.** ACI 318 - Building Code Requirements for Reinforced Concrete.
- C.** ASTM A82 - Standard Specification for Steel Wire, Plain, For Concrete Reinforcement.
- D.** ASTM A184 - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
- E.** ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- F.** ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
- G.** ASTM A497 - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
- H.** ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- I.** ASTM A706 - Standard Specification for Low-Alloy Steel Deformed Bars for Concrete

**SECTION 03200**  
**CONCRETE REINFORCEMENT**

Reinforcement.

- J.** AWS D1.4 - Structural Welding Code for Reinforcing Steel.
- K.** CRSI - Concrete Reinforcing Steel Institute Manual of Practice.
- L.** Chapter 19A, California Building Code.

**1.3 SUBMITTALS**

- A.** Shop Drawings: Submit steel reinforcement Shop Drawings in accordance with ACI 315. Include assembly diagrams, bending charts and slab plans. Indicate lengths and location of splices, size and lengths of reinforcing steel.
- B.** Closeout Submittals: Record exact locations of reinforcing that vary from Shop Drawings.

**1.4 QUALITY ASSURANCE**

- A.** Provide Testing Laboratory with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.
- B.** Comply with the following as a minimum requirement:
  - 1. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice.
  - 2. American Welding Society (AWS)
  - 3. American Concrete Institute (ACI)
  - 4 CBC, Chapter 19A, Concrete
- C.** Source Quality Control: Refer to Division 01 Sections for general requirements and to the following paragraphs for specific procedures. Testing laboratory retained by the Owner shall select test Samples of Bars, ties, and stirrups from the material at the Project Site or from the place of distribution, with each Sample consisting of not less than two 18 inch long pieces, and perform the following tests according to ASTM A615, or ASTM A706, as applicable:
  - 1. Identified Bars: If Samples are obtained from bundles as delivered from the mill,

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identified as to heat number, accompanied by mill analyses and mill test reports, and properly tagged with the identification certificate so as to be readily identified, perform one tensile and one bend test for each 10 tons or fraction thereof of each size of bars. Submit mill reports when Samples are selected.

2. Unidentified Bars: When positive identification of reinforcing bars cannot be performed and when random Samples are obtained; perform tests for each 2.5 tons or fraction thereof, one tensile and one bend test from each size of bars.

**D.** Certification of Welders: Shop and project site welding shall be performed by welding operators certified by AWS.

**1.5 DELIVERY, STORAGE AND HANDLING**

- A.** Avoid exposure to dirt, moisture or conditions harmful to reinforcing material.
- B.** Reinforcing steel bars, wire, and wire fabric shall be stored on the Project site to permit easy access for examination and identification of each shipment. Material of each shipment shall be separated for size and shape.

**1.6 COORDINATION**

- C.** Coordinate with placement of formwork, formed openings and other Work.

**Part 2 PRODUCTS**

**2.1 MATERIALS**

- A.** Reinforcing Steel: ASTM A 615, or ASTM A706, 60 yield grade deformed low alloy steel for No. 4 bars or larger; 40 yield grade, No. 3 bars for ties and stirrups. Conform to Section 1903A, California Building Code 19A.
- B.** Welding Electrodes: Low Hydrogen grade E70XX for Grade 40, E90XX for Grade 60.

**2.2 ACCESSORY MATERIALS**

- A.** Tie Wire: Minimum 16 gage black annealed type.
- B.** Chairs, Bolsters, Bar Supports, and Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.

- C.** Special Chairs, Bolsters, Bar Supports, and Spacers Adjacent to Weather Exposed



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Concrete Surfaces: Plastic coated steel type; size and shape as required.

- D.** Concrete Blocks: Approximately 3 inches dimension each side.

**2.3 FABRICATION**

- A.** Fabricate concrete reinforcing in accordance with CRSI Manual of Practice and ACI 315 and ACI 318. Wherever possible, make bends to shape in fabricator's shop.
- (1)** Bars reduced in section will not be accepted.
  - (2)** Bars with kinks are unacceptable.
  - (3)** Bars shall not be heated to facilitate bending or for any other purpose.
  - (4)** Bars with bends not indicated on drawings will not be accepted. Perform no forming in a manner which will damage bars.
- B.** Weld reinforcement in accordance with AWS D1.4.
- C.** Locate reinforcing splices not indicated on Drawings at point of minimum stress.

**Part 3 EXECUTION**

**3.1 PLACEMENT**

- A.** Place, support and secure reinforcement against displacement. Do not deviate from required position. Install concrete blocks to support reinforcement over grade.  
Smooth face rocks not permitted.
- B.** Do not displace or damage vapor barrier where vapor barrier is specified or indicated on drawings.
- C.** Accommodate placement of formed openings.
- D.** Prior to placing, thoroughly clean reinforcement of all rust, dirt, dust, oil or any other material deleterious to bonding of concrete.
- E.** Accurately place and securely tie reinforcement at all intersections and splices with black annealed wire and securely hold in position during placing of concrete by means of precast concrete block supports. Point wire tie ends away from the form.  
Unless otherwise indicated, the number, type, and spacing of supports shall conform to the ACI 315.

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- F.** During placing of structural concrete slabs, provide a full-time reinforcing steel placer to repair and replace reinforcing to its proper location. Provide additional chairs of the proper size available to place under bars displaced during the concrete pouring operation.
- G.** Dowels for Walls: Securely tie in place prior to placing of concrete. Do not place dowels in concrete after pour.
- H.** Dowels for Slabs: Securely tie in place prior to placing concrete. Per Plans or Drawings. Do not place dowels in concrete after pour.
- I.** Conform to Section 1907A, California Building Code for concrete cover over reinforcement.

**3.2 CLEAN UP**

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

**3.3 PROTECTION**

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

**END OF SECTION**

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**Part 1    GENERAL**

**1.1        WORK INCLUDED**

- A.** Provisions of Division 01 apply to this section.
- B.**     Sections Includes:
  - 1. Cast-in-place normal weight and lightweight concrete, placement and finishing.
- C.** Related Sections:
  - 1. Section 02770: Site Concrete Work.
  - 2. Section 03100: Concrete Forms and Accessories.
  - 3. Section 03200: Concrete Reinforcement.

**1.2        REFERENCES**

- A.** American Concrete Institute (ACI) Publication:
  - 1. ACI 117-Specifications for Tolerances for Concrete Construction and Materials.
  - 2. ACI 301-Specifications for Structural Concrete.
  - 3. ACI 302.1R-Guide for Concrete Floor and Slab Construction.
  - 4. ACI 305.1-Specification for Hot Weather Concreting.
  - 5. ACI 306.1-Standard Specification for Cold Weather Concreting.
  - 6. ACI 318-Building Code Requirements for Structural Concrete, as modified by CBC Sections 1903A and 1908A.
- B.** American Society for Testing and Materials (ASTM) Standards:
  - 1. ASTM C31-Standard Specification for Making and Curing Concrete Test Specimens in the Field.
  - 2. ASTM C33-Standard Specification For Concrete Aggregates.
  - 3. ASTM C39-Standard test Method for Compressive Strength of Cylindrical Concrete Specimens.
  - 4. ASTM C42-Standard Test Method For Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

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5. ASTM C88-Standard Test Method for Soundness of Aggregates by use of Sodium Sulphate or Magnesium Sulphate.
6. ASTM C94-Standard Specification for Ready-Mixed Concrete.
7. ASTM C143-Standard Test Method for Slump of Hydraulic Cement Concrete.
8. ASTM C150-Standard Specification for Portland Cement.
9. ASTM C171 -Standard Specification for Sheet Materials for Curing Concrete.
10. ASTM C172-Standard Practice for Sampling Freshly Mixed Concrete.
11. ASTM C173-Standard Test Method for Air Content for Freshly Mixed Concrete by the Volumetric Method.
12. ASTM C260-Standard Specification for Air-Entraining Admixtures for Concrete.
13. ASTM C289-Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
14. ASTM C309 - Liquid Membrane - Forming compounds for Curing Concrete.
15. ASTM C330-Standard Specification for Lightweight Aggregates for Structural Concrete.
16. ASTM C494-Standard Specification for Chemical Admixtures for Concrete.
17. ASTM C567-Standard Test Method for Determining Density of Structural Lightweight Concrete.
18. ASTM C618-Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
19. ASTM C845-Standard Specification for Expansive Hydraulic Cement.
20. ASTM C856 - Practice for Petrographic Examination of Hardened Concrete.
21. ASTM C989-Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
22. ASTM C1064-Standard Test Method from Temperature of Freshly Mixed Hydraulic-Cement Concrete.
23. ASTM C1107-Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

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- 24. ASTM C1240-Standard Specification for Silica Fume Used in Cementitious Mixtures.
- 25. ASTM C1567-Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combination of Cementitious Materials and Aggregate. (Accelerated Mortar-Bar Method)
- 26. ASTM D1751-Standard Test Method for Performed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
- 27. ASTM E96-Standard Test Methods for Water Vapor Transmission of Materials.
- 28. ASTM E1155-Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers.
- 29. ASTM E1643-Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- 30. ASTM E1745-Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

**1.3 SUBMITTALS**

- A.** Shop Drawings: Submit shop Drawings indication locations of cast-in-place concrete work and accessory items such as vapor barriers. Include details and location of reinforcing, embedded items, and interfacing with other Work.
- B.** Mix Design Data: Submit concrete mix designs as specified herein and in Article 2.02.
  - 1. Submit name, address and telephone number of the concrete production facility which the contractor intends to engage to design the concrete mixes. Submit name and qualifications of the proposed concrete technologist.
  - 2. Mix Design: Submit a concrete mix design for each strength and type of concrete indicated in the drawings or specified. Include water/cement ratio, source, size and amount of coarse aggregate and admixtures. Predict minimum compressive strength, maximum slump and air content percentage. Clearly indicate locations where each mix design will be used.
  - 3. Test Reports: Submit Copies of test reports showing that the proposed mixes produce concrete with the strengths and properties specified. Include tests for cement, aggregates and admixtures. Provide gradation analysis.
- C.** Material Samples: Submit Samples illustrating concrete finishes and hardeners,

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minimum 12 X 12 inches in size.

- D.** Certificates: Submit certification that each of the following conforms to the standards indicated:
1. Portland cement: ASTM C150
  2. Normal weight concrete aggregates: ASTM C33.
  3. Lightweight concrete aggregates: ASTM C330
  4. Aggregates: Submit evidence that the aggregate is not reactive in the presence of cement alkalis. In the absence of evidence, aggregate shall be tested per ASTM C289. If results of test are other than innocuous, aggregates shall be tested per ASTM C1567 as required by CBC, Section 1903A.
  5. Curing materials: ASTM C171.
- E.** Admixtures: Submit product data for proposed concrete admixtures.

**1.4 Quality Assurance**

- A.** Continuous inspection shall be provided at the batch plant and for transit-mixed concrete to run check sieve analysis of aggregate, check moisture content of fine aggregate, check design of mix, check cement being used with test reports, check loading of mixer trucks, and certify to quantities of materials placed in each mixer truck.
- B.** Inspection shall be performed by a representative of a DSA approved testing laboratory selected by the Owner. Owner will pay for inspection costs. Notify the laboratory 24 hours in advance of time concrete is to be mixed. Notify the laboratory of postponement or cancellation of mixing within at least 24 hours of scheduling time.
- C.** Contractor shall assist the testing laboratory in obtaining and handling samples at the project site and at the source of materials.
- D.** Continuous batch plant inspection requirement may be waived in accordance with CBC Section 1704A4.4. Waiver shall be in writing, including DSA approval. When batch plant inspection is waived by DSA, the following requirements shall be met:
1. Approved inspector of the testing laboratory shall check the first batching at the start of work and furnish mix proportions to the licensed weighmaster.
  2. Licensed weighmaster shall positively identify materials as to quantity and certify to each load by a ticket.
  3. Tickets shall be transmitted to the PI by a truck driver with load identified

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thereon. The PI will not accept the load without a load ticket identifying the mix and will keep a daily record of placements, identifying each truck, its load and time of receipt and approximate location of deposit in the structure and will transit a copy of the daily record to DSA.

4. At the end of the project, the weightmaster shall furnish an affidavit to DSA certifying that all concrete furnishes conforms in every particular to proportions established by mix designs.
- E. Special Inspections and Test shall be in accordance with CBC Chapter 17A, CBC Section 1916A and Specification Section 01420.

**1.5 DELIVERY, STORAGE AND HANDLING**

- A. Store cement and aggregate materials so as to prevent their deterioration or intrusion by foreign matter, Deteriorated or contaminated materials shall not be furnished.
- B. Packaged materials shall bear the manufacturers and brand name label, and shall be stored in their original unbroken package in a weather tight place until ready for use in the work.

**1.6 PROJECT CONDITIONS**

- A. Cold Weather Requirements: Batching, mixing, delivering and placing of concrete in cold weather shall comply with the applicable requirements of ACI 306.1.
- B. Hot Weather Requirements: Batching, Mixing, delivering and placing of concrete in hot weather shall comply with the applicable requirements of ACI 305R.
- C. Concrete temperature of freshly mixed concrete shall be determined per ASTM C1064.

**Part 2 PRODUCTS**

**2.1 MATERIALS**

- A. Cement: ASTM C150, Portland cement.
- B. Aggregates: Conform to the following standards:
  1. Normal weight concrete: ASTM C33
  2. Lightweight concrete: ASTM C330, with fine aggregates per ASTM C33.
  3. Aggregate shall be tested for Potential Alkali Reactivity of Cement-Aggregate Combinations per ASTM C289.

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4. Nominal maximum size of course aggregate shall be no larger than:
- a.  $1/5^{\text{th}}$  the narrowest dimension between sides of forms, nor
  - b.  $1/3^{\text{rd}}$  the depth of slabs, nor
  - c.  $3/4$  the clear spacing between individual reinforcing bars or wires, of bars, individual tendons, or ducts.
  - d. Contractor may request the Architect and DSA waiver of the above limitations per CBC Section 1903 A.3, provided that the workability and methods of consolidation are such that the concrete can be placed without honeycombs or voids.
- bundles

**C. Water:** Water for concrete mixes, curing and cleaning shall be potable and free from deleterious matter.

**D. Admixtures:** Shall be shown capable of maintaining essentially the same composition and performance throughout the work as the product used in establishing concrete proportions in accordance with ACI 318, Section 3.6.

1. Admixtures containing chlorides or sulfides are not permitted.
2. Air-entering admixtures shall comply with ASTM C260, Air-entrained admixtures shall not be used for floor slabs to receive steel trowel finish.
3. Admixtures for water reduction and setting time modification shall conform to ASTM C494.
4. Admixtures for producing flowing concrete shall conform to ASTM C1017.

**Note to Specifier:** Use of fly ash and blast-furnace slag is encouraged to reduce the impact of cement manufacture. Determine if the use of fly ash and blast-furnace slag is acceptable, available at a competitive price, and would not result in inadequate bid competition. If not used, delete article 5 below. If used, verify percentage of Portland cement replacement and indicate amount in space provided below, and delete the brackets. If not used throughout project, clearly indicate areas where it will be used.

5. Fly ash, pozzolan and ground granulated blast-furnace slag: Modify ACI 318 Sections 3.6.6 and 3.6.7 as follows:
  - a. Fly ash or other pozzolan used as a partial substitution for ASTM C150 Portland cement shall meet the following requirements:
    - 1) Shall conform to ASTM C618 for Class N or F materials (Class C is not permitted).
    - 2) [ ] percent by weight of fly ash or other pozzolans shall substitute for



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ASTM C150 Portland Cement Provided the mix design is proportioned per Section 1905A.3 and the durability requirements of Section 1904A are met.

- b. Ground-granulated blast-furnace slag used as a partial substitution for ASTM C150 Portland cement shall meet the following requirements:
  - 6. Admixtures containing ASTM C845 expansive cements shall be compatible with the cement and produce no deleterious effects.
  - 7. Silica fumes used as an admixture shall conform to ASTM C1240.
- E.** Reinforcement Fibers: Chop strands of alkali-resistant polypropylene or nylon fibers added to the concrete mix for protection against shrinkage cracks.
- F.** Expansion Joint Fillers: Performed strips, non-extruding and resilient bituminous type, of thickness indicated, conforming to ASTM D1751.
- G.** Curing Paper: Shall conform to ASTM C171 and consist of two sheets of kraft paper cemented together with a bituminous material in which are embedded cords or strands of fiber running in both directions. The paper shall be light in color, shall be free of visible defects, with uniform appearance.
- H.** Floor Hardener: Water soluble, inorganic, silicate-based curing, hardening, sealing and dustproofing compound. Aquaseal W20 by Monopole Inc., Kure-N-Harden by BASF, Chem Hard by L&M, Liqui-Hard by W. R. Meadows, or equal.
- I.** Underlayment: Two component latex underlayment for filling low spots in concrete for both interior and exterior applications, from feathered edge to maximum of 3/8<sup>th</sup> inch in thickness. Underlayment shall be non-shrink and suitable for repairing exposed coverings. La\_O\_Test by Tex Rite, Underlay C or RS by Mer-Krete Systems, Underlayment 962 by C-Cure, or equal.
- J.** Vapor Barrier: Polyolefin-based 15 mils minimum thickness, meeting or exceeding ASTM E1745, 10 feet minimum width. Permeance shall be less than 0.01 perms [grain/(ft<sup>2</sup>\*hr\*inHg)] as determined by ASTM E96 or ASTM F1249 and after mandatory conditioning test per ASTM E154 Sections 8, 11, 12, & 13. Include accessories including tape and/or mastic. Stego Wrap by Stego Industries LLC or Perminatory by W.R. Meadows, Ecoshield-E by Epro, or equal.
- K.** Stairs Strips and Nosing:
  - 1. Fabricated from 6063-T5 extruded aluminum, mill finish, Anti-slip filler shall contain at least 60 percent virgin grain aluminum oxide abrasive. Binder shall be fully cured resilient type epoxy, with binder-to filler ratio of 13 percent. The epoxy-abrasive filler shall extend over the curved front edge of the nosing and shall be securely bonded to the extruded aluminum base.

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2. Manufactured by Wooster Products Inc. American Safety Tread Co. Inc., or equal.
3. Nosing and strips for concrete casting shall be provided with Sure-Hold Anchors, chevron shaped continuous full length of nosing or strip.
4. Nosing and anchors for attachments to hydrated concrete stairs and wood stairs shall be similar to those specified below, except they shall be provided with countersunk holes for screws and fasteners.
5. Colors: As selected by Architect to contrast with stair color. Colors shall extend uniformly through the filler.
6. Strip and Nosing Types:
  - a. Nosings for sloped riser steel pan stairs Type WP4J, 4-1/16<sup>th</sup> inches wide, 3/8<sup>th</sup> inch thick.
  - b. Nosings for new concrete stairs: Type WP4C, 4-1/16<sup>th</sup> inches wide, 3/8<sup>th</sup> inch thick, nose projects down 1/4 inch.
  - c. Nosings for square edge steel pan stairs: Type WP4SP, 4-1/16<sup>th</sup> inches wide, 3/8<sup>th</sup> inch thick nose.
  - d. Strips for recessing into concrete stairs: Type WP1A, except 2-1/4 inches wide, 3/8 inch thick. American Safety Tread Co., Type 24, or equal.
  - e. Strips for adhering to existing or hydrated concrete: Flex-Tred anti-safety strips, minimum 2-1/4 inches wide. Cut from rolls and round corners.
  - f. Strips for anchoring into wood or stone: American Safety Tread Co., Type t-24H, or equal, with holes for fasteners, 2-1/4 inches wide.
- L. Grout: ASTM C1107, non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 7 days; of consistency suitable for application and a 30 minute working time.

**2.2 CONCRETE MIX**

- A. Mix shall be signed and sealed by a Civil or Structural Engineer currently registered in the State of California.
- B. Strength of Concrete: Strengths and types of concretes shall be as indicated in the Drawings. Unless otherwise indicated or specified, concrete shall be provided with a minimum 28-day strength of 3000 psi (fc).

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- C.** The required strength and durability of concrete shall be determined by compliance with the proportioning, testing, mixing and placing provisions of CBC Sections 1905A.1 through 1905A.13. Concrete mix shall meet the durability requirements of ACI 318, Chapter 4.
- D.** Concrete proportioning shall be determined on the basis of field experience and/or trial mixtures shall in accordance with ACI 318, Section 5.3. Proportions of materials shall provide workability and consistency to permit concrete to be placed readily into forms and around reinforcement under conditions of placement to be employed, without segregation or excessive bleeding.
- E.** Ready-Mixed Concrete: Mix and deliver in accordance with requirements of ASTM C94.

**Part 3 EXECUTION**

**3.1 GENERAL**

- A.** Surfaces to receive concrete shall be free of debris, standing water, and any other deleterious substances before start of concrete placing.
- B.** Time of Placing: Do not place concrete until reinforcement, conduits, outlet boxes, anchors, hanger, sleeves, bolts, and other embedded materials are securely fastened in place. Contact the PI at least 24 hours before placing concrete; do not place concrete until inspected by PI.
- C.** Pouring Record: a record shall be kept on the Project site of time and date of placing concrete in each portion of structure. Such record shall be maintained on the Project site until Substantial Completion and shall be available for examination by the Architect and DSA.

**3.2 TOLERANCES**

- A.** Concrete construction tolerances shall be as specified in ACI 117 and as modified herein.
- B.** Floor Flatness ( $F_F$ ) and Floor Levelness ( $F_L$ ) shall be indicated below:

	Specified Overall Value		Minimum Local Value	
	$F_F$	$F_L$	$F_F$	$F_L$
Slabs on Ground: mechanical and electrical rooms, parking structures and mortar bed set tile and quarry flooring.	20	15	15	10
Slab on ground: carpet.	25	20	17	15
Slab on Ground: thinset tile and resilient flooring	35	25	24	17
Suspend slabs: mechanical and electrical rooms, parking structures and mortar bed set tile and quarry flooring.	20	15	N/A	N/A

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Suspend slabs: carpet.	25	20	N/A	N/A
Suspend slabs: thinset tile and resilient flooring.	35	20	N/A	N/A

- C.** Refer to ACI 302.1R, Tables 8.1 and 8.2 Slab on Ground and Suspend Flatness/Levelness Construction Guide, for recommended concrete placing and finishing methods.
- D.** Floor Flatness and Floor Levelness shall be tested in accordance to ASTM E1155. Floor measurements shall be made within 48 hours after slab installation, and shall precede removal of shores and forms.

**3.3 PREPARATION**

- A.** Vapor Barrier: Before Installation of screeds and slab reinforcement, install vapor barrier under slabs on grade, as indicated in the drawings.
  - 1. Install in accordance to ASTM E1643.
  - 2. Place vapor retarder sheeting with the longest dimension parallel with the direction of the concrete pour.
  - 3. Laps or seams shall be overlapped 6 inches, or as recommended by manufacturer. Laps and penetrations shall be sealed with the manufacturer's recommended tape and/or mastic.
  - 4. PI will inspect and mark areas of damage and insufficient installation of the vapor barrier sufficiently in advance of concrete placement.
    - a. Deficiencies shall be corrected before concrete is placed.
    - b. Patch damaged areas with vapor barrier overlapping all four sides 6 inches and adhering with tape.
- B.** Reglets and Rebates:
  - 1. Form reglets and rebates in concrete to receive flashing, frames and other equipment as detailed and required. Coordinate dimensions and locations required with other related Work.
  - 2. If concrete slabs on grade adjoin a wall or other perpendicular concrete surface, form a reglet in wall to receive and carry horizontal concrete Work. Reglet shall be full thickness of the slab and shall be  $\frac{3}{4}$  inch wide, unless otherwise indicated. Requirement does not apply to exterior walks, unless specifically indicated.

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- C.** Anchor Slots: Embedded anchor slots in concrete walls to receive masonry veneer shall be set vertically in forms, 24 inches maximum on centers measured horizontally; Anchor slots shall be No. 24 gage galvanized sheet steel with removable fiber filler to prevent seepage of cement in slot.
- D.** Screeds: Install screeds accurately and maintain in required grade or slab elevations after steel reinforcement has been installed, but before starting to place concrete. Install screeds adjacent to walls and in parallel rows not to exceed 8 feet on centers.

**3.4        INSTALLATION**

**A.** Conveying and Placing:

- 1.** Concrete shall be placed only under direct observation of the PI. Do not place concrete outside of regular working hours, unless the PI has been notified at least 48 hours in advance.
- 2.** Concrete shall be conveyed from mixer to location of final placement by methods that will prevent separation or loss of materials.
- 3.** Concrete shall be placed as nearly as practicable to its final position to avoid segregation due to re-handling or flowing. No concrete that has partially hydrated or has been contaminated by foreign materials shall be placed, nor shall re-tempered concrete or concrete which has been remixed after initial set be placed.
- 4.** In placing concrete in columns, walls or thin sections, provide openings in forms, elephant trunks, tremies or other recognized devices, to prevent segregation and accumulation of partially hydrated concrete on forms or metal reinforcement above level of concrete being placed. Such devices shall be installed so that concrete will be dropped vertically. Unconfined vertical drop of concrete from end of such devices to final placement surface shall not exceed 6 feet.
- 5.** Concrete shall be placed as a continuous operation until placing of panel or section is completed. Top surfaces of vertically formed lifts shall be level.
- 6.** Concrete shall be thoroughly consolidated by suitable means during placement, and shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms.
- 7.** Where conditions make consolidation difficult or where reinforcement is congested, batches of mortar containing some proportions of cement, sand, and water as provided in the concrete, shall first be deposited in the forms to a depth of at least one inch.

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**B. Cold Weather:**

1. Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather. All ground with which concrete is to come in contact shall be free from frost. No frozen materials or materials containing ice shall be used.
2. The temperature of concrete at the time of placement shall not below the minimum temperatures given in Table 3.1 of ACI 306.1.
3. Concrete shall be maintained at a temperature of at least 50°F. for not less than 72 hours after placing or until it has thoroughly hardened. Cover concrete and provide sufficient heat as required. When necessary, aggregates shall be heated before mixing. Special precautions shall be taken for protection of transit-mixed concrete.

**C. Hot Weather:**

1. Concrete to be placed during hot weather shall comply with the requirements of ACI 318, Section 5.13.
2. Maintain concrete temperatures indicated in Table 2.1.5 of ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square feet of exposed concrete per hour.
3. Cool Concrete using methods indicated in ACI 305R Appendix B.
4. Place and cure concrete as specified in ACI 305R Chapter 4.

**D. Compaction and Screeding:**

1. Tamp freshly placed concrete with a heavy tamper until at least 3/8 inch of mortar is brought to surface. Concrete shall then be tamped with a light tamper and screeded with a heavy straightedge until depressions and irregularities are eliminated, and surface is true to finish grades or elevations. Remove excess water and debris.
2. Where slabs are to receive separate cement finish or mortar setting bed, continued tamping to raise mortar to surface is not performed. Laitance shall be removed by brushing with a stiff brush or by light sandblasting to expose clean top surface of course aggregate.

**E. Floating and Troweling:**

1. When concrete has hydrated sufficiently, it shall be floated to a compact and smooth surface. After floating, wait until concrete has reached proper consistency before troweling. Top surfaces shall receive at least 2 troweling operations with steel hand trowel. Prior to and during final troweling, apply a fine mist of water

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frequently with an atomizing type fog sprayer. Omit troweling for slabs to receive a separate cement finish.

2. For interior finish slabs, final troweling shall provide a hard, impervious, and non-slip surfaces, free from defects and blemishes. Finished surface shall be within tolerances indicated in Article 3.02. Avoid burnishing. Do not add cement or sand to absorb excess moisture.
  - a. Floor of Walk-In Refrigerator: Finish as specified above, to a smooth finish.
3. Floor of Gymnasium Locker Rooms: After floating, and while the surface is still plastic, provide a fine textured finish by drawing a fine fiber bristle broom uniformly over the surface in one direction only. Floors sloped for drainage should be brushed in the direction of flow.
4. Exterior Paving and Cement Walks: Finish as specified above, except surface shall be given a non-slip broom finish to match Sample reviewed by the Architect.
5. Vertical concrete surfaces shall be finished smooth and free from marks or other surface defects.

**F. Curing:**

1. Length of Time, temperature and moisture conditions for curing concrete shall be in accordance with ACI 318, Section 5.11.
2. Forms containing concrete, top of concrete between forms, and exposed concrete surfaces after removal of forms shall be maintained in a thoroughly wet Condition for at least 7 consecutive days after placing.
3. If weather is hot or surface has dried out, spray surface of concrete slabs and paving with a fine mist of water, starting not later than 2 hours after final troweling and continuing until sunset. Surface of finish shall be kept continuously wet until curing medium has been installed.
4. Immediately after finishing, monolithic floor slabs shall be covered with curing paper. Paper shall be lapped 4 inches at joints and sealed with waterproof sealer. Edges shall be cemented to finish. Repair or replace paper damaged during construction operations.

**G. Filling, Leveling and Patching:**

1. Concrete slabs exhibiting high or low spots and indicated to receive resilient floor covering or soft floor covering, shall have surfaces repaired. High spots shall be honed, or ground with power-driven machines to required tolerances. Low spots shall be filled with latex underlayment, installed in strict accordance with manufacturer's written recommendations.
2. Holes resulting from form ties or sleeve nuts shall be solidly packed, through

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exterior walls, by pressure grouting with cement grout, as specified. Grouted holes on exposed surfaces shall be screeded flush and finished to match adjoining surfaces.

- H. Cement Base:** Cement base shall be of the height, thickness, and shape detailed. Base shall be reinforced with one inch mesh, 18 gage, zinc-coated wire fabric. Base finish mixture shall be one part Portland cement, 2 parts of fine aggregate and one part pea gravel. Colored cement base shall include a chemically inert mineral oxide pigment in the mix.

**3.5 FINISHING**

- A. Soda and Acid Wash:** Concrete surfaces to receive plaster, paint or other finish, and which have been formed by oil coated forms, shall be scrubbed with a solution of 1-1/2 pounds of caustic soda to one gallon of water. Surfaces where smooth wood or waste molds have furnished shall be scrubbed with a solution of 20 percent muriatic acid. Wash with clean water after scrubbing.
- B. Sacking:** exposed concrete curbs, walls, and other surfaces shall be sacked by an application of Portland cement grout, floated, and rubbed. Sacking shall not be performed until patching and filling of holes has been completed. Entire sacking operation for any continuous area shall be started and completed within the same day.
1. Mix one part Portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having a consistency of thick paint. Wet surface of concrete sufficiently to prevent absorption of water from the grout. Apply grout uniformly with a brush or spray gun, then immediately float surface with a cork or other suitable float, scouring wall vigorously.
  2. While grout is still plastic, finish surface with a sponge-rubber float, removing excess grout. Allow surface to dry thoroughly, and then rub vigorously with dry burlap to completely remove dried grout. No visible file or grout shall remain after rubbing with burlap.
- C. Sandblasting;** Exterior concrete surfaces to receive stucco dash coat finish, where plywood or other smooth forms have been furnished, shall be uniformly sandblasted with sharp quartz sand under sufficient air pressure to remove dirt, form oil and other foreign materials, and roughen surface to provide a proper bond. Such surfaces shall be thoroughly washed with clean water after sandblasting.
- D. Abrasive:** Concrete stair treads, landings, ramps and steps on interior and exterior of buildings, and interior exposed concrete floors in shop buildings shall receive an abrasive finish.
- E. Floor Hardener:** Exposed interior concrete floors throughout shall be treated with



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floor hardener.

1. Protect adjacent surfaces. Clean surfaces to receive treatment in accordance with manufacturer's instructions, ensuring that all stains, oil, grease, form release agents, laitance, dust and dirt are removed prior to application.
  2. Apply hardener in accordance with manufacturer's instructions as soon as concrete is firm enough to work on after final troweling.
- F.** Cement Grout and Dry-Pack Concrete: Cement grout shall be mixed at the Project site and shall be composed of one volume of Portland cement and 2-1/2 volumes of fine aggregate. Materials shall be mixed dry with sufficient water added to make mixture flow under its own weight. When grout is used as a dry pack concrete, add sufficient water to provide a stiff mixture, which can be molded into a sphere.
- G.** Broom Finish: Exterior stair treads and landing shall be provided with a non-slip broom finish in addition to abrasive finish specified.
- H.** Abrasive Stair Nosing: Nosing shall be installed according to manufacturer's written recommendations.

**3.6 EXPANSION AND CONSTRUCTION JOINTS**

- A.** Construction Joints: Details and proposed location of Construction joints shall be indicated on the Drawings, located to least impair strength of structure, in accordance with the following:
1. Thoroughly clean contact surface by sand blasting entire surface not earlier than 5 days after initial placement.
  2. A mix containing same proportion of sand and cement provided in concrete plus a maximum of 50 percent of coarse aggregate shall be placed to a depth of at least one inch on horizontal joints. Vertical joints shall be wetted and coated with a neat cement grout immediately before placing of new concrete.
  3. Should contact surface become coated with earth, sawdust, or deleterious material of any kind after being cleaned, entire surface shall be re-cleaned before applying mix.
- B.** Expansion Joints: Provide expansion joint where indicated in walks and exterior slabs. Space approximately 20 feet apart, unless otherwise indicated. Joints shall extend entirely through slab with joint filler in one piece for width of walk or slab. Joint filler shall be 3/8 inch thick, unless otherwise indicated.
- C.** Tooled Joints: Slabs, walks and paving shall be marked into areas as indicated with

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markings made with a V-grooving tool. Marks shall be round-edged, free from burrs or obstructions, with clean cut angles and shall be straight and true. Walks, if not indicated, shall be marked off into rectangles of not more than 12 square feet and shall have a center marking where more than 5 feet wide.

**3.7 TESTING**

**A. Molded Cylinder Tests:**

1. Testing lab personnel will prepare cylinders and perform slump tests. Samples for concrete strength shall be taken in accordance to ASTM C172. Each cylinder shall be dated, given a number, point in structure form which sample was obtained, mix design number, mix design strength and result of accompanying slump test noted.
2. Separate tests of molded concrete cylinders obtained at same place and time shall be made at age of 3 days, 7 days, and 28 days. A strength test shall be the average of the compressive strength of 2 cylinders, obtained from the same sample of concrete and tested at 28 days or at test age designed for determination of  $f_c$ .
3. Test cylinders shall be prepared at the Project site and stored in testing laboratory in accordance with ASTM C31, and tested in accordance with ASTM C39.

**B. Core Test:** At request of the Architect, cores of hardened concrete shall be cut from portions of hydrated structures for testing, in accordance with CBC and ASTM C42.

1. Provide 4 inch diameter cores at representative places throughout the structure as designated by the Architect.
2. In general, provide sufficient cores to represent concrete placed with at least one core for each 4,000 square feet of building area, and at least 3 cores total for each Project.
3. Where cores have been removed, fill voids with drypack, and patch the finish to match the adjacent existing surfaces.

**C. Concrete Consistency:** Measure consistency according to ASTM C143. Test twice each day or partial day's run of the mixer.

**D. Adjustment of Mix:** If the strength of any grade of concrete for any portion of Work, as indicated by molded test cylinders, falls below minimum 28 days compressive strength specified or indicated, adjust mix design for remaining portion of construction so that resulting concrete meets minimum strength requirements.

**E. Air Content Testing:** Measure in accordance ASTM C173 or ASTM C231, for each

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composite sample taken in accordance to ASTM C172.

**F. Defective Concrete:**

1. Should strength or any grade of concrete, for any portion of Work indicated by test of molded cylinders and core tests, fall below minimum 28 days strength specified or indicated, concrete will be deemed defective Work and shall be replaced or adequately strengthened in a manner acceptable to the Architect, DSA and Owner.
2. Concrete Work that is not formed as indicated, is not true within 1/250 of span, not true to intended alignment, not plumb or level where so intended, not true to intended grades and levels, contains sawdust shavings, wood or embedded debris, or does not fully conform to the Contract provisions, shall be deemed to be defective Work and shall be removed and replaced.

**G. Concrete for Equipment Pads, Mechanical and Electrical Work:** Unless otherwise indicated, strength shall have a minimum  $f_c=3000$  psi. Exposed concrete shall be provided with a hand trowel finish and with radius corners and edges. Form and place concrete where necessary as described in Section 03100: Concrete Forms and Accessories, and reinforced as described in Section 03200: Concrete reinforcement. Calcium chloride shall not be furnished in any concrete mix provided for the installation of underground electrical conduits. For concrete encasement of more than one conduit, furnish  $\frac{3}{4}$  inch maximum aggregate.

**3.8 CLEAN UP**

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

**3.9 PROTECTION**

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

**SECTION 03310  
SLAB ON GRADE CONCRETE**

**Part 1    GENERAL**

**1.1        SECTION INCLUDES**

- A.** Cast-in-place concrete.
- B.** Floors and slabs on grade.
- C.** Control, expansion and contraction joint devices associated with concrete work including joint sealants.
- D.** Concrete fill for steel pan stairs.
- E.** Concrete for curbs, gutter, sidewalks and other site-related concrete is specified in Section 02770 Sitework Concrete.
- F.** Under slab termite control as specified in Section 02360.

**1.2        REFERENCES**

- A.** ACI 301 - Structural Concrete for Buildings.
- B.** ACI 318 - Building Code Requirements for Reinforced Concrete.
- C.** ASTM C33 - Concrete Aggregate.
- D.** ASTM C150 - Portland Cement.
- E.** ASTM C171 - Sheet Materials for Curing Concrete.
- F.** ASTM C330 - Lightweight Aggregates for Structural Concrete.
- G.** ASTM C1107 - Packaged Dry, Hydraulic - Cement Grout (Non-Shrink).
- H.** ASTM D1751 - Preformed Expansion Joint Filler for Concrete (Bituminous Type).
- I.** Chapter 19A, California Building Code.
- J.** UBC Standard No. 19-1 - Portland Cement and Blended Hydraulic Cements.
- K.** UBC Standard No. 19-4 - Concrete made by Volumetric Batching and Continuous Mixing.

**1.3        SUBMITTALS**

**SECTION 03310  
SLAB ON GRADE CONCRETE**

- A.** Placement Schedule: Submit for approval details and/or sketches showing location of each proposed construction joint. Do not deviate from locations of horizontal joints indicated on drawings.
- B.** Submit product data for each type of manufactured material and product included.
- C.** Submit design mix for each concrete mix.
- D.** Submit steel reinforcement shop drawings, including material, grade bar schedules, spacing, bent bar diagrams, arrangement and supports.

**1.4 PROJECT RECORD DOCUMENTS**

- A.** Accurately record actual locations of embedded utilities and components which are concealed from view.
- B.** Maintain an accurate record showing date and time of concrete placement in each portion of structure. Correlate placing record for test cylinders made by testing laboratory. Maintain a separate record giving date of removal of forms, shoring, including first and second halves and re-shoring, if used. Keep records available for inspection at site. Upon completion, deliver two copies of each to Architect in approved form.

**1.5 QUALITY ASSURANCE**

- A.** Perform Work in accordance with Section 1905A, California Building Code, and ACI 318.
- B.** Maintain one copy of all records.
- C.** Acquire cement and aggregate from same source for all work.
- D.** Conform to Section 1905A, California Building Code, when concreting during hot weather. No concrete placement permitted above 90 degrees Fahrenheit.
- E.** Conform to Section 1905A, California Building Code, when concreting during cold weather. No concrete placement permitted below 50 degrees Fahrenheit.

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**1.6 COORDINATION**

- A.** Coordinate the placement of joint devices with erection of concrete formwork and placement of form accessories.

**Part 2 PRODUCTS**

**2.1 CONCRETE MATERIALS**

- A.** Cement: ASTM C150, Type I or II. Portland Type, conforming to Section 1903A, California Building Code and UBC Standard No. 19-1.
- B.** Aggregates:
  - (1)** Aggregate for Stone Concrete: ASTM C33.
  - (2)** Combined Aggregate for Stone Concrete: Table 19A-J, California Building Code.
  - (3)** Aggregate for Lightweight Concrete: ASTM C330.
- C.** Conform to requirements specified herein for maximum size of aggregate permitted in individual applications.
- D.** Water: Clean and not detrimental to concrete from domestic source.

**2.2 ACCESSORIES**

- A.** Bonding Agent: Polyvinyl Acetate Latex emulsion; HIBOND, manufactured by Lambert Corporation, Orlando FL, LOCK BOND NO. 906, manufactured by Macklanburg-Duncan Co., City of Industry, CA, or equal as approved in accordance with Section 01600 for substitutions.
- B.** Curing Film: ASTM C171; 4 mil thick, clear polyethylene film, single sheet, manufactured from virgin resin with no scrap or additives, free of visible defects, uniform in appearance, conforming to the following:
  - (1)** Moisture Loss: 0.055 g per sq. cm.
  - (2)** Tensile Strength: 1700 psi longitudinal, 1200 psi transverse.

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SLAB ON GRADE CONCRETE**

**(3)** Elongation: 225 percent longitudinal, 350 percent transverse.

- C.** Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 5,000 psi in 24 hours and 8,000 psi in 7 days; of consistency for application and a 30 minute working time.
- D.** Reinforced Vapor Barrier: Griffolyn Vaporguard as manufactured by Reef Industries, Inc., Houston, TX., use appropriate tape and pipe boots, or equal as approved in accordance with Section 01600 for substitutions.

**2.3 JOINT DEVICES AND FILLER MATERIALS**

- A.** Expansion Joint Filler: ASTM D1751; Closed cell, bituminous saturated fiberboard; 1/2 inch thick, FIBER EXPANSION JOINT manufactured by The Burke Company, or equal as approved in accordance with Section 01600 for substitutions.
- B.** Expansion Joint Top: Integral extruded polystyrene plastic; 1/2 inch thick, with removable top strip exposing sealant trough, JOINT CAPS manufactured by The Burke Company, or equal as approved in accordance with Section 01600 for substitutions.
- C.** Sealant: Polyurethane multi-component type, non-sagging or self leveling at flatwork, as specified in section 07900.
- D.** Primer: As recommended by sealant manufacturer.
- E.** Saw-Cut Joint Filler: Two-component epoxy resin, gray color, non-hardening, self-leveling, SIKADUR 51 (SL), by Sikacorp., Lyndhurst, NJ, or equal as approved in accordance with Section 01600 for substitutions.

**2.4 CONCRETE MIX**

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**A.** Mix and deliver concrete in accordance with Section 1905A, California Building Code and UBC Standard No. 19-4. Deliver concrete in transit mixers only. Discharge loads in less than 1-1/2 hours after water is first added.

**(1)** Design Mix: Method B, by an approved Testing Laboratory, certified by a registered Professional Engineer licensed in California.

**(2)** Do not exceed 0.45 water-cement ratio by weight for floor slabs and 0.49 for other concrete.

**B.** Select proportions for concrete in accordance with the approved design mix.

**(1)** Required Strength: As noted on the structural drawings and below.

**(2)** Grout Mix: 1:3:2 Portland Cement to pea gravel, to sand, minimum 3000 psi at 28 days.

**(3)** Fill for Steel Pan Stairs: Same as grout mix, except add minimum amount of water to provide a low slump mix. Minimum 28 day strength: 2,000 psi.

Install ASTM A185 6 x 6 - W1.4 x W1.4 welded wire reinforcing at landing pans and install in tread pans KEYDECK mesh as manufactured by Keystone Steel and Wire Peoria, IL., or equal as approved in accordance with Section 01600 for substitutions.

**C.** Provide concrete to the following criteria:

Element	Min 28 day Strength PSI	Max Slump	Max Size Aggregate
Grade Beams and Foundations (N.W. Conc)	3,000	4 inch	1-1/2 inch
Flr. Slabs on grade (N.W. Conc)	3,000	4 inch	1 inch



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SLAB ON GRADE CONCRETE**

- D.** Miscellaneous Sitework Concrete: Specified in Section 02750, Sitework Concrete.
- E.** Do not use admixtures containing chlorides for floor slabs.

**Part 3 EXECUTION**

**3.1 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.

**3.2 PREPARATION**

- A.** Prepare previously placed concrete by cleaning with sandblasting to remove laitance and expose clean aggregate.
- B.** In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with approved epoxy.
- C.** When approved by the Architect, clean previously placed concrete with steel brush and apply bonding agent in accordance with manufacturer's instructions.
- D.** Under interior slab on grade, unless otherwise noted on the drawings, install 4 inches of sand, place reinforced vapor barrier, and cover vapor barrier with 2 inches of sand, install #3 rebar 18" o.c. each way at mid depth of slab, prior to concrete placement.
- E.** Seal all penetrations of vapor barrier and joints as recommended by manufacturer.

**3.3 PLACING CONCRETE**

- A.** Place concrete in accordance with Section 1905A, California Building Code. Remove loose dirt from excavations.

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- B.** Notify Architect and Project Inspector a minimum of 24 hours prior to commencement of operations. All excavations, forms and reinforcing shall be inspected and approved by the Project Inspector prior to placement.
- 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.** When detailed on the drawings, separate slabs on grade from vertical surfaces with 1/2 inch thick joint filler.
- F.** Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface using two-component polyurethane sealant as specified in Section 07900.
- G.** Install joint devices in accordance with manufacturer's instructions as detailed.
- H.** Install construction joint device in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- I.** Maintain joint device in correct position to allow joint cover flush with finish.
- J.** Install joint covers in longest practical length.
- K.** Place concrete continuously between predetermined expansion, control and construction joints.
- L.** Do not interrupt successive placement; do not permit cold joints to occur.
- M.** 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.

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- N.** Provide special mix prepared by the Testing Laboratory and approved by the Architect utilizing smaller aggregates in areas of reinforcing congestion to prevent the formation of rock pockets.
- O.** 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. Utilize trunks or additional chutes where doubt occurs.
- P.** Construction Joints: Wash surface of each joint shortly after pouring to expose clean, sound aggregate. Sandblast surface to remove laitance remaining or loose aggregate as approved by the Architect. Conform to Section 1906A, California Building Code.
- Q.** Screed floors and slabs on grade level, maintaining surface flatness of maximum 1/8 inch in 10 ft. Slope floors for drains.
- R.** Saw-cut slabs as approved by the Architect at 15 ft oc, maximum 225 sf, within 24 hours after placing, with 3/16 inch thick blade. Cut no deeper than 1/4 depth of slab thickness. Fill cuts with specified non-hardening epoxy. Completely fill cuts to surface of slab.

**3.4        SEPARATE FLOOR TOPPINGS**

- A.** Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.
- B.** Place required dividers, edge strips, reinforcing and other items to be cast in.
- C.** Apply bonding agent to substrate in accordance with manufacturer's instructions.
- D.** Place concrete floor toppings to required lines and levels. Place topping in checkerboard panels, maximum dimension not to exceed 20 ft.
- E.** Screed toppings level, maintaining surface flatness of maximum 1/8 inch in 10 ft.

**3.5        CONCRETE FINISHING**

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- A.** Provide formed concrete surfaces to be left exposed with smooth rubbed finish, as scheduled.
- B.** Finish all slab on grade/floor surfaces to requirements of Section 03350.

**3.6 CURING AND PROTECTION**

- A.** Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures and mechanical injury.
- B.** Maintain concrete with minimal moisture loss at above 50 degrees F temperature for period necessary for hydration of cement and hardening of concrete. Dusting with dry cement to absorb excess water is prohibited.
- C.** Cure floor surfaces only as specified herein and in accordance with Section 1905A, California Building Code. Membrane curing compound method not permitted for interior cast-in-place concrete slabs.
- D.** Moisture Cure: Keep surface of floor slabs moist. Spray water over floor slab areas and maintain wet for minimum of seven (7) days or spread polyethylene film over floor 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 minimum of seven (7) days. Do not permit traffic over floor slabs during the seven (7) day curing period.
- E.** Vertical Surfaces: Spray water over surfaces and maintain wet for 10 days.
- F.** Quality Control: Proper curing of concrete surfaces shall be the responsibility of the Contractor under this section.

**3.7 FIELD QUALITY CONTROL**

- A.** Provide free access to Work and cooperate with Testing Laboratory.

**SECTION 03310  
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- B.** Proposed mix design of each class of concrete shall conform to Section 1905A, California Building Code and shall be approved by the Architect prior to commencement of work.

**3.8        PATCHING**

- A.** Architect will inspect concrete surfaces and determine imperfections, if any.
- B.** Patch imperfections as approved and in accordance with ACI 301.
  - (1)**    Clean all exposed concrete surfaces and all adjoining work stained by leakage of concrete. Remove all fins, butts and projections by grinding. Patch voids, rock pockets, holes, cracks and similar imperfections by chipping loose concrete and exposing clean, sound aggregate.
  - (2)**    Fill cone form tie recesses with portland cement mortar flush to finish surface.

**3.9        DEFECTIVE CONCRETE**

- A.** Defective Concrete: Remove concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B.** Repair or replacement of defective concrete will be determined by the Architect.
- C.** Do not patch, fill, touch-up, repair or replace exposed concrete except upon express approval of Architect for each individual area.

**3.10       MOISTURE TEST FOR CONCRETE FLOORS**

- A.** It shall be the General Contractor's responsibility to provide a concrete floor slab meeting the maximum moisture vapor emissions here-in specified and the contractor shall exercise care in all aspects of mixing, placing, and curing the concrete floor slabs so that a minimum of mitigation treatment will be required.
- B.** Prior to ordering floor materials that are adhesive applied, contractor shall conduct Calcium-Chloride "Dome" tests to verify that concrete floor slabs are dry with maximum moisture vapor emissions of three lbs. per 1,000 s.f. in 24 hours and that

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slabs exhibit negative alkalinity, carbonization or dusting. Apply the moisture test in four (4) different areas of each floor location, with at least one test for each 1,000 s.f. of floor area.

- C.** Should the moisture emissions exceed three lbs. per 1,000 s.f. in 24 hours as specified here-in at the time of installation of adhesive applied floor coverings, and the Petrographic Analysis, ASTM C856, confirms that the placement of concrete slabs was not in conformance with requirements of this section and that the water cement ratio exceeded 0.45 or the concrete was cured less than 7 days, the General Contractor, at no additional cost to the Owner, shall reduce the moisture emission level to that specified by use of a vapor emission treatment system as specified in Section 07265.

**END OF SECTION**

## **SECTION 04 20 00 - UNIT MASONRY**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Concrete block.
- B. Mortar and grout.
- C. Reinforcement and anchorage.
- D. Flashings.
- E. Accessories.

#### **1.02 REFERENCE STANDARDS**

- A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.
- B. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019.

#### **1.03 SUBMITTALS**

- A. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- B. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

### **PART 2 PRODUCTS**

#### **2.01 CONCRETE MASONRY UNITS**

- A. Concrete Block: Comply with referenced standards and as follows:
  - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depth of 8 inches.
  - 2. Special Shapes: Provide non-standard blocks configured for corners.

#### **2.02 MORTAR AND GROUT MATERIALS**

#### **2.03 REINFORCEMENT AND ANCHORAGE**

- A. Reinforcing Steel:
  - ASTM A615/A615M, Grade 40 (40,000 psi), deformed billet bars; galvanized. #3 and smaller
  - ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars: galvanized. #4 and larger

#### **2.04 MORTAR AND GROUT MIXING**

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
  - 1. Exterior, non-loadbearing masonry: Type M OR S.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

#### **3.02 PREPARATION**

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

### **3.03 COURSING**

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
  - 1. Bond: Running.

### **3.04 PLACING AND BONDING**

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Remove excess mortar and mortar smears as work progresses.
- C. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

### **3.05 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY, AND CAVITY WALL MASONRY**

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.
- B. Lap joint reinforcement ends minimum 6 inches.

### **3.06 CLEANING**

- A. Remove excess mortar and mortar droppings.
- B. Clean soiled surfaces with cleaning solution.

### **3.07 PROTECTION**

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

**END OF SECTION**



## **SECTION 05120 STRUCTURAL STEEL**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Provisions of Division 01 apply to this section
- B. Section Includes:
  - 1. Structural steel.
- C. Related Sections:
  - 1. Section 01420: Testing and Inspection.
  - 2. Section 03300: Cast-In-Place Concrete.
  - 3. Section 04820: Concrete Unit Masonry.
  - 4. Section 05300: Metal Decking.
  - 5. Section 05500: Metal Fabrications.
  - 6. Section 07810: Cementitious Fireproofing.
  - 7. Section 09900: Paints and Coatings.

#### **1.2 REFERENCE STANDARDS, SPECIFICATIONS AND CODES**

- A. CBC Chapter 22A.
- B. American Institute of Steel Construction (AISC):
  - 1. AISC – Steel Construction Manual, 14<sup>th</sup> Edition, including:.
    - a. AISC 360 Specifications for Structural Steel Buildings.
    - b. AISC Code of Standard Practice for Steel Buildings and Bridges.
    - c. RCSC –  
Specification for Structural Joints Using ASTM A325 or A490 Bolts.
- C. American Society for Testing and Materials (ASTM):
  - 1. ASTM A36 – Standard Specification for Carbon Structural Steel.
  - 2. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - 3. ASTM A108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
  - 4. ASTM A123 – Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.

**SECTION 05120  
STRUCTURAL STEEL**

5. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
6. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60000 PSI Tensile Strength.
7. ASTM A325 – Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 Ksi Minimum Tensile Strength.
8. ASTM A435 - Standard Specification for Straight-Beam Ultrasonic Examination of Steel Plates.
9. ASTM A490 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
10. ASTM A500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
11. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
12. ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
13. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
14. ASTM A673 - Standard Specification for Sampling Procedure for Impact Testing of Structural Steel,
15. ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
16. ASTM A992 – Standard Specification for Structural Steel Shapes.
17. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).
18. ASTM E23 - Standard Test Methods for Notched Bar Impact Testing of Metallic Materials.
19. ASTM E112 - Standard Test Methods for Determining Average Grain Size

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20. ASTM F1554 – Standard Specification for Anchor Bolts, Steel, 36, 55 and 105-Ksi Yield Strength.
  21. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
  22. ASTM F1852 – Standard Specification for “Twist Off” Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tension Strength.
- D. American Welding Society (AWS):
1. AWS D1.1 – Structural Welding Code - Steel.
  2. AWS D1.8 – Structural Welding Code – Seismic Supplement.
  2. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
  3. AWS B2.1 – Specifications for Welding Procedures and Performance Qualification.
- E. SSPC – Steel Structures Painting Council:
1. SP-2 - Hand Tool Cleaning.

**1.3 SYSTEM DESCRIPTION**

- A. Regulatory Requirements:
1. Structural steel shall conform to CBC requirements, except that steel manufactured by acid Bessemer process is not permitted for structural purposes.
  2. Sheet and strip steel other than those listed in CBC, if provided for structural purpose, shall comply with DSA requirements.

**1.4 SUBMITTALS**

- A. Shop Drawings:
1. Submit Shop Drawings, including complete details and schedules for fabrication and shop assembly of members, and details, schedules, procedures and diagrams showing the sequence of erection. Fully detail minor connections and fastenings not shown or specified in the Contract Documents to meet required conditions using similar detailing as shown in the Contract Documents. Include a fully detailed, well controlled sequence and technique plan for shop and field welding that minimizes locked in stresses and distortion; submit sequence and technique plan for review by the Architect.
    - a. Include details of cuts, connections, camber, and holes in accordance with Figure 4.5 of AWS D1.1 or AISC Chapter J, weld position plan and other pertinent data. Indicate welds by standard AWS symbols, and show size, length and type of each weld.

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- b. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed for Work specified in other sections.
- c. Erection and Bracing Plan and Erection Procedure: Submit an erection and framing plan, including columns, beams, and girders, signed and sealed by a Structural or Civil Engineer registered in the State of California in accordance with Title 8 CCR, Section 1710, Erection of Structures. Maintain a copy at the Project site as required by the California Division of Industrial Safety.
- d. Submit a list of steel items to be galvanized.
- e. Include identification and details of AECS members, if applicable.

**B. Product Data:**

- 1. Submit copies of fabricator's specifications and installation instructions for the following products. Include laboratory test reports and other data required demonstrating compliance with these Specifications:
  - a. Structural steel, each type; including certified copies of mill reports covering chemical and physical properties.
  - b. Welding electrodes.
  - c. Welding gas.
  - d. Unfinished bolts and nuts.
  - e. Structural steel primer paint.
  - f. High-strength bolts, including nuts and washers.

**C. Manufacturer's Mill Certificate:**

- 1. Submit, certifying that products meet or exceed specified requirements.

**D. Mill Test Reports:**

- 1. Submit manufacturer's certificates, indicating structural yield and tensile strength, destructive and non-destructive test analysis.

**E. Welding Procedure Specifications (WPS):** Submit weld procedures for all welding on project to Owner's testing laboratory for approval. After approval by testing laboratory, submit to Architect for record. Weld procedures shall be qualified as described in AWS D1.5, AISC 341 and AISC 358, as applicable. Weld procedures shall indicate joints details and tolerances, preheat and interpass temperature, post-heat treatment, single or multiple stringer passes, peening of stringer passes for groove welds except for the first and the last pass, electrode type and size, welding current, polarity and amperes and root treatment. The welding variables for each stringer pass shall be recorded and averaged, from these averages the weld heat input shall be calculated. Submit the manufacturer's product data sheet for all welding material used.

**F. Welder's Certificates:** Field welders shall be Project certified in accordance with

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AWS D1.1. Shop welders shall be Project certified for FCAW in accordance with AWS D1.1.

- G. Test Reports: Submit reports of tests conducted on shop and field welded and bolted connections. Include data on type of test conducted and test results.
- H. Welding Material Certification: Provide certificate that welding material complies to specifications. Submit to Owner's testing laboratory.

### **1.5 QUALITY ASSURANCE**

- A. Comply with the following as a minimum requirement, except as otherwise indicated:
  - 1. Perform welding in accordance with AWS Standards, AWS D1.1, and California Building Code Section 2004A.1 and approved Weld Procedure Specifications (WPS).
- B. Shop fabrication shall be inspected in accordance with CBC.
- C. Erect mock-up panel of fabricated structural steel meeting Architecturally Exposed Structural Steel (AESS) tolerances for exposed areas. Approval by Architect is required. Mock-up to remain for comparison but may not be left as part of the work.

### **1.6 DELIVERY, STORAGE AND HANDLING**

- A. Store structural steel above grade on platforms, skids or other supports.
- B. Protect steel from corrosion.
- C. Store welding electrodes in accordance with AWS D 12.1.
- D. Store other materials in a weather-tight and dry place until installed into the Work.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Stock Materials: Provide exact materials, sections, shapes, thickness, sizes, weights, and details of construction indicated on Drawings. Changes because of material stock or shop practices will be considered if net area of shape or section is not reduced thereby, if material and structural properties are at least equivalent, and if overall dimensions are not exceeded.
- B. All shapes, bars, plates, tubes and pipes shall be made of materials with at least 16% recycled content if produced from Basic Oxygen Furnace (BOF) or at least 67% recycled content if produced from Electric Arc Furnace (EAF).

### **2.2 MATERIALS**

- A. Structural Steel: All wide flange shapes shall conform to ASTM A992 grade 50. Other steel shall conform to ASTM A36.

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- B. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular low carbon bolts and nuts.
- C. High-Strength Threaded Fasteners: ASTM A325, ASTM A490 ASTM F959 or ASTM F1852 quenched and tempered, steel bolts, nuts and washers.
- D. Primer: Lead-free metal primer, Tnemec 10-99, Rust-Oleum X-60, or equal.
- E. Steel Pipe: ASTM A53, Type E or S, Grade B.
- F. Structural Tubing:
  - 1. Hot-formed, ASTM A501.
  - 2. Cold-formed, ASTM A500, Grade B.
- G. Galvanizing: ASTM A123.
- H. Shear stud connectors: ASTM A108, Grade 1015 forged steel, headed, uncoated, granular flux filled shear connector or anchor studs by Nelson Stud Welding Division of TRW, Lorain, OH, or equal.
- I. Grout: ASTM C1107, non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 7 days; of consistency suitable for application and a 30 minute working time.

### **2.3 FABRICATION**

- A. Cleaning and Straightening Materials: Materials being fabricated shall be thoroughly cleaned of scale and rust, and straightened before fabrication. Cleaning and straightening methods shall not damage material. After punching or fabrication of component parts of a member, twists or bends shall be removed before parts are assembled.
- B. Cutting, Punching, Drilling and Tapping: Unless otherwise indicated or specified, structural steel fabricator shall perform the cutting, punching, drilling and tapping of Work so that Work of other trades will properly connect to steel Work.
- C. Milling: Compression joints depending on contact bearing shall be furnished with bearing surfaces prepared to a common plane by milling.
- D. Use of Burning Torch: Oxygen cutting of members shall be performed by machine. Gouges greater than 3/16 inch that remain from cutting shall be removed by grinding. Reentrant corners shall be shaped notch free to a radius of at least 1/2 inch. Gas cutting of holes for bolts or rivets is not permitted.
- E. Galvanizing: After fabrication, items indicated or specified to be galvanized shall be galvanized in largest practical sizes. Fabrication includes operations of shearing, punching, bending, forming, assembling or welding. Galvanized items shall be free from projections, barbs, or icicles resulting from the galvanizing process.
- F. Welding:

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1. Type of steel furnished in welded structures shall provide chemical properties suitable for welding as determined by chemical analysis. Welds shall conform to the verification and inspection requirements of CBC Chapter 17A. Conform to AWS D1.1, and CBC Chapter 22A.
  2. Materials and workmanship shall conform to the requirements specified herein and to CBC requirements, modified as follows:
    - a. No welded splices shall be permitted except those indicated on Drawings unless specifically reviewed by the Architect.
    - b. Drawings will designate joints in which it is important that welding sequence and technique be controlled to minimize shrinkage stresses and distortion.
  3. Welding shall be performed in accordance with requirements of the AWS Structural Welding Code.
  4. Architecturally Exposed Structural Steel: 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 ½ inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.
  5. Remove erection bolts on welded, Architecturally Exposed Structural Steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- G. Shop Finish:
1. Notify the PI when Work is ready to receive shop prime coat. Work shall be inspected by the PI before installation of primer.
  2. Structural steel and fittings, except galvanized items, which will be exposed when building is completed, shall receive a coat of primer.
  3. The primer specified shall be spray applied, filling joints and corners and covering surfaces with a smooth unbroken film. The minimum dry film thickness of the primer shall be 2.0 mils.
  4. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete or high strength bolted.
- H. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.
- I Fabricate Architecturally Exposed Structural Steel with exposed surfaces smooth, square, and free of surfaces 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

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"Code of Standard Practice for Steel Buildings and Bridges" for  
Architecturally Exposed Structural Steel.

- J. Architecturally Exposed Structural Steel: use special care in unloading, handling and erecting the steel to avoid marking or distorting the steel members. Minimize damage to any shop paint when temporary braces or erection clips are used. Avoid unsightly surfaces upon removal. Grind smooth tack welds and holes filled with weld metal or body solder. Plan and execute all operations in such a manner that the close fit and neat appearance of the structure will not be impaired.

**2.4 SHOP AND FIELD QUALITY CONTROL**

- A. A special inspector, approved by DSA to inspect the Work of this section, shall inspect high-strength bolted connections. The Owner will provide a DSA approved independent testing laboratory to perform tests and prepare test reports in accordance with CBC 1704A.3.3. The PI shall be responsible for monitoring the work of the special inspector and testing laboratories to ensure that the testing program is satisfactorily completed.
- B. An AWS CWI certified special inspector, approved by DSA to inspect the Work of this section, shall inspect welded connections in accordance with CBC 1704A.3.1. The Owner will provide a DSA approved independent testing laboratory to perform tests and prepare test reports. The PI shall be responsible for monitoring the work of the special inspector and testing laboratories to ensure that the testing program is satisfactorily completed.
- C. The independent testing laboratory shall conduct and interpret test and state in each report whether test specimens comply with requirements, and specifically state any deviations there from.
- D. Provide access to all places where structural steel Work is being fabricated or produced so required inspection and testing can be performed.
- E. The independent testing laboratory may inspect and/or test structural steel at plant before shipment; however, Architect reserves the right at any time before Contract Completion to deem materials not in compliance with the specified requirements as defective Work.
- F. Correct defects in structural Work when inspections and laboratory test reports indicate noncompliance with specified requirements. Perform additional tests as may be required to reconfirm noncompliance of original Work, and as may be required to show demonstrate compliance of corrected Work.
- G. Welding: Inspect and test during fabrication and erection of structural steel assemblies as follows:
1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in the Work. Record Work required and performed to correct deficiencies.
  2. Inspect welds. Welds shall be visually inspected before performing any non-destructive testing. Groove weld shall be inspected by ultrasonic or other approved non-destructive test methods. Testing shall be performed to AWS D1.1 Table 6.3 cyclically loaded non-tubular connections.



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3. Ultrasonic testing shall be performed by a specially trained and qualified technician who shall operate the equipment, examine welds, and maintain a record of welds examined, defects found, and disposition of each defect. Repair and test defective welds.
  4. Rate of Testing: Completed welds contained in joints and splices shall be tested 100 percent either by ultrasonic testing or by radiography.
  5. Welds, when installed in column splices, shall be tested by either ultrasonic testing or radiography.
  6. Base metal thicker than 1-1/2 inches, when subjected to through-thickness weld shrinkage strains, shall be ultrasonically inspected by shear wave methods for discontinuities directly behind such welds. Tests shall be performed at least 48 hours after completed joint has cooled down to ambient air temperature.
  7. Any material discontinuities shall be reviewed based on the defect rating in accordance with the criteria of AWS D1.1 table 6.3 by the Architect and DSA.
  8. Other method of non-destructive testing and inspection, for example, liquid dye penetrate testing, magnetic particle inspection or radiographic inspection may be performed on weld if required.
  9. Lamellar Tearing: Lamellar-tearing resulting from welding is a crack (with zero tolerance) and shall be repaired in accordance with AWS D1.1.
  10. Lamination: The rejection criteria shall be based on ASTM A435.
  11. Where testing reveals lamination or conditions of lamellar tearing in base metal, the steel fabricator shall submit a proposed method of repair for review by the Architect. Test repaired areas as required.
  12. Magnetic Particle Testing: Magnetic particle testing when required shall be provided in accordance with AWS D1.1 for procedure and technique. The standards of acceptance shall be in accordance with AWS D1.1 – Qualification.
- H. Lamellar Tearing: Prior to welding plates 1 to 1-1/2 inches thick and greater and rolled shapes within the distance from 6 inches above the top of the joint to 6 inches below the bottom of the joint shall be checked by ultrasonic testing for laminations in base metal which may interfere with the inspection of the completed joint. Should these defects occur, members will be reviewed by the Architect and DSA. Welding procedure specifications in sub-section 1.5G specify welding practices to minimize lamellar tearing.
- I. Prior Testing of Base Material: Test material before fabrication.
- J. Lines and levels of erected steel shall be certified by a State of California licensed surveyor as set forth in related Division 01 section.
- K. Welded studs shall be tested and inspected by the special inspector in accordance with requirements of AWS D1.1 – Stud Welding.
- L. Record Drawings: After steel has been erected, correct or revise Shop Drawings and erection diagrams to correspond with reviewed changes performed in the

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field.

**PART 3 - EXECUTION**

**3.1 PREPARATION**

- A. Verify governing dimensions and conditions of the Work before commencing erection Work.
  - 1. Report discrepancies between drawings and field dimensions to Architect before commencing work.
  - 2. Beginning of installation means erector accepts existing conditions and surfaces underlying or adjacent to work of this section.
- B. Provide temporary shoring and bracing, and other support during performance of the Work. Remove after steel is in place and connected, and after cast-in-place concrete has reached its design strength.

**3.2 ERECTION**

- A. Install structural steel accurately in locations, to elevations indicated, and according to AISC specifications and CBC requirements.
- B. Clean surfaces of base plates and bearing plates.
  - 1. Install base and bearing plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims; cut off flush with edge of base or bearing plate before packing with grout.
- C. Maintain erection tolerances of structural steel within AISC Code of Standard Practice for Steel Buildings and Bridges.
  - 1. Architecturally Exposed Structural Steel members and components, plumbed, leveled and aligned to a tolerance not to exceed one-half the amount permitted for structural steel. Contractor to provide adjustable connections between Architecturally Exposed Structural Steel and the structural steel frame or the masonry or concrete supports, in order to provide the erector with means for adjustment.
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact after assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
- E. Do not permit thermal cutting during erection of structural steel.
- F. Where indicated for field connections, provide standard bolts complying with ASTM A307.
- G. Install high strength steel bolts at locations indicated. Assembly and installation shall be in accordance with CBC requirements.

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1. Allowable hole sizes: 1/16 inch larger than bolt size.
  2. Use friction type connection with standard hardened steel circular, square or rectangular washer under bolt nut.
  3. Thoroughly clean area under bolt head, nut and washer. Remove all paint, lacquer, oil or other coatings except organic zinc-rich paints in accordance with SSPC, SP-2.
  4. Tighten bolts by power torque wrench or hand wrench until twist-off.
- H. Contractor shall be responsible for correcting detailing and fabrication errors and for correct fitting of all members and components.
- I. Erect structural steel plumb and level and to proper tolerances as set forth in the AISC Manual. Provide temporary bracing, supports or connections required for complete safety of structure until final permanent connections are installed.
- J. Install column bases within a tolerance of 1/8 inch of detailed centerlines, level at proper elevations. Support bases on double nuts and solidly fill spaces under bases with cement grout.
- K. Provide anchor bolts with templates and diagrams. Contractor shall be responsible for proper location and installation of bolts. Correct deficiencies and errors.
- L. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A780.

### **3.3 FITTING**

- A. Closely fit members, finished true to line and in precise position required to allow accurate erection and proper joining in the field.
- B. Drilling to enlarge unfair holes will not be allowed. Allow only enough drifting during assembly to bring parts into position, but not enough to enlarge holes or distort the metal. Do not heat rolled sections, unless approved by Architect.

### **3.4 PUNCHING AND DRILLING**

- A. Punch material 1/16 inch larger than nominal diameter of bolt, wherever thickness of metal is equal to or less than the diameter of the bolt plus 1/8 inch.
- B. Drill or sub-punch and ream where metal is equal to or more than the diameter of the bolt plus 1/8 inch. Make diameter for sub-punched and sub-drilled holes 1/16 inch larger than nominal diameter of bolt.
- C. Precisely locate holes to ensure passage of bolt through assembled materials without drifting. Enlarge holes when necessary to receive bolts by reaming; flame cutting to enlarge holes is not acceptable. Structural Steel members with poorly matched holes will be rejected.

### **3.5 FINISHING**

- A. After erection, spots or surfaces where paint has been removed, damaged, or burned off and field rivets, bolts, and other field connections not concealed in the work, shall be cleaned of dirt, oil, grease, and burned paint and furnished with a spot coat of the same primer installed during shop priming.

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- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Install paint to exposed areas with the same material installed during shop painting. Install by brush or spray to provide a minimum dry film thickness of 1.5 mils.

**3.6 FIELD QUALITY CONTROL**

- A. Owner will provide a special inspector and independent testing laboratory to perform field inspections and tests and to prepare test reports.
- B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

**3.7 CLEAN UP**

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

**3.8 PROTECTION**

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

**3.9 HANDLING**

- A. Both in shop and in the field, transport, handle and erect to prevent damage or overstressing of any component.

**END OF SECTION**

## **SECTION 05 12 13 - ARCHITECTURALLY-EXPOSED STRUCTURAL STEEL FRAMING**

### **PART 1 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Additional requirements for structural steel members designated as architecturally-exposed structural steel (AESS).

#### **1.02 RELATED REQUIREMENTS**

- A. Section 05 12 00 - Structural Steel Framing: General requirements for structural steel members, including AESS framing specified in this section.
- B. Section 09 91 13 - Exterior Painting: Finish coat requirements and coordination with primer and surface preparation specified in this section.
- C. Section 09 91 23 - Interior Painting: Finish coat requirements and coordination with primer and surface preparation specified in this section.
- D. Section 09 96 00 - High-Performance Coatings: Finish coat requirements and coordination with primer and surface preparation specified in this section.

#### **1.03 REFERENCE STANDARDS**

- A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.
- B. AISC 360 - Specification for Structural Steel Buildings; 2016.
- C. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2019.
- D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2020.
- E. ASTM A1085/A1085M - Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS); 2015.
- F. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- G. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

#### **1.04 SUBMITTALS**

- A. Product data for each type of product specified. Submit paint systems in accordance with Section 09 91 13.
- B. Shop Drawings: Detailing for fabrication of AESS components.
  - 1. Provide erection documents clearly indicating which members are AESS members and the AESS category of each part.
  - 2. Include details that clearly identify AESS requirements found in this specification. Provide connections for AESS consistent with concepts shown on drawings.
  - 3. Indicate welds by AWS A2.4 symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds as defined by the designated AESS category.

#### **1.05 QUALITY ASSURANCE**

- A. Fabricator Qualifications: In addition to those qualifications listed in Section 05 12 00, engage an AISC Certified Fabricator, experienced in fabricating AESS similar to that indicated for this project with a record of successful in-service performance, as well as sufficient production capacity to fabricate AESS without delaying the work.
- B. Comply with applicable provisions of AISC 303, Section 10 for the designated AESS category.

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

- A. Handle finished pieces in accordance with Section 10 of AISC 303, using nylon-type slings, or chains with softeners, or wire ropes with softeners such that they are not damaged.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged

materials from erosion and deterioration. Use special care in handling to prevent twisting or warping of AESS members.

## **PART 2 - PRODUCTS**

### **2.01 GENERAL REQUIREMENTS**

- A. Comply with Section 05 12 00, except as amended in this section for aesthetic purposes.

### **2.02 FABRICATION**

- A. Fabricate and assemble AESS in shop to greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by Architect. Detail AESS assemblies to minimize field handling and expedite erection.
- B. Permissible tolerances for member depth, width, out of square, and camber and sweep to be as specified in ASTM A6/A6M, ASTM A500/A500M, and ASTM A1085/A1085M.
- C. Use special care in handling and shipping of AESS both before and after shop painting to minimize damage to any shop finish. Use nylon-type slings or softeners when using chains or wire rope slings.
- D. Fabricate AESS in accordance with categories defined in AISC 303, as follows:
  - 1. AESS 1: Basic elements.
  - 2. AESS 2: Feature elements viewed at a distance greater than 20 feet (feature elements not in close view).
  - 3. AESS 3: Feature elements viewed at a distance less than 20 feet (feature elements in close view).

### **2.03 PAINT SYSTEM**

- A. Compatibility: All components/procedures of AESS paint system to comply with coating system specified, submitted, and approved per Sections 09 91 13, 09 91 23, and 09 96 00. As a minimum, identify required surface preparation, primer, intermediate coat (if applicable), and finish coat. Primer, intermediate coating, and finish coating to be from a single manufacturer combined in a system documented by manufacturer with adequate guidance for fabricator to procure and execute.
- B. Primer: As specified in Sections 09 91 13, 09 91 23, and 09 96 00. Primer to comply with all federal standards for VOC, lead and chromate levels.
- C. Finish Coating: Field apply intermediate and top coats per Sections 09 91 13, 09 91 23, and 09 96 00.

### **2.04 SHOP PRIMING**

- A. Surface Preparation:
  - 1. Provide surface preparations to meet SSPC-SP 6.
- B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted with slip-critical connections.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Erector to check all AESS members upon delivery for twist, kinks, gouges or other imperfections which may result in rejection of appearance of member. Coordinate remedial action with fabricator prior to erecting steel.

### **3.02 PREPARATION**

- A. Provide connections for temporary shoring, bracing and supports only where noted on approved fabrication documents. Temporary connections not shown are to be made at locations not exposed to view in final structure or as approved by Architect.
- B. Handle, lift and align pieces using nylon straps or chains with softeners required to maintain appearance of AESS through process of erection.

### **3.03 ERECTION**

- A. AESS 1 and 2: Basic elements; feature elements not in close view:
  - 1. Employ special care to handle and erect AESS. Erect finished pieces using nylon straps or chains with softeners such that they are not damaged.
  - 2. Place weld tabs for temporary bracing and safety cabling at points concealed from view in completed structure or where approved by Architect during pre-installation meeting. Obtain Architect approval of methods for removing temporary devices and finishing AESS members prior to erection.
  - 3. AESS Erection Tolerances: Erect to standard frame tolerances for structural steel per Chapter 7 of AISC 303.
  - 4. Set AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
  - 5. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures.
  - 6. Remove all backing and run out tabs.
  - 7. When temporary braces or fixtures are required to facilitate erection, take care to avoid any blemishes, holes or unsightly surfaces resulting from use or removal of such temporary elements.
- B. AESS 3: Feature elements in close view:
  - 1. Erect to requirements of AESS 1 and 2 and as follows:

### **3.04 CLEANING**

- A. Touch-up Painting: Complete cleaning and touch-up painting of field welds, bolted connections, and abraded areas of shop paint to blend with adjacent surfaces of AESS. Perform touch-up work in accordance with manufacturer's instructions and as specified in Section 09 91 13, 09 91 23, and 09 96 00.

**END OF SECTION**

## **SECTION 05500 METAL FABRICATIONS**

### **Part 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A.** Shop fabricated ferrous metal items, galvanized and prime painted.

#### **1.2 REFERENCES**

- A.** ASTM A992, Grade 50 - Structural Steel.
- B.** ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- C.** ASTM A123 - Zinc Coating (Hot-Dip) on Iron and Steel Products.
- D.** ASTM A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- E.** ASTM A167 - Stainless Steel and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
- F.** ASTM A283/A283M - Low and Intermediate Tensile Strength Carbon Steel Plates.
- G.** ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile.
- H.** ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- I.** ASTM C1107 - Packaged Dry Hydraulic - Cement Grout (Non-Shrink).
- J.** AWS A2.4 - Standard Welding Symbols.
- K.** AWS D1.1 - Structural Welding Code.
- L.** AWS A5.1 - Carbon Steel Covered Arc-Welding Electrodes.
- M.** SSPC Paint 21 - Steel Structures Painting Council - White or Colored Silicone Alkyd Paint.

#### **1.3 SUBMITTALS**

- A.** Submit Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners and accessories. Include erection drawings, elevations and details where applicable. Indicate welded connections using standard



**SECTION 05500  
METAL FABRICATIONS**

AWS A2.4 Welding Symbols. Indicate net weld lengths.

**1.4 FIELD MEASUREMENTS**

- A.** Verify field measurements.

**Part 2 PRODUCTS**

**2.1 MATERIALS**

- A.** Steel Sections: ASTM A992, Grade 50.
- B.** Steel Tubing: ASTM A500, Grade B.
- C.** Plates: ASTM A283; Milled Steel.
- D.** Pipe: ASTM A53, Grade B, Schedule 40.
- E.** Fasteners: Standard commercial quality steel as required for application.
- F.** Bolts, Nuts and Washers: ASTM A307 galvanized to ASTM A153 for galvanized components. Unless noted otherwise on Drawings.
- G.** Shop and Touch-Up Primer: SSPC Paint 21, Series P10-99 modified alkyd, red color, air dried, by Tnemec or equal as approved in accordance with Section 01600 for substitutions.
- H.** Touch-Up Primer for Galvanized Surfaces: Ready mixed Zinc rich galvanizing compound, DEVCON 2, by Devcon Corp., Danvers, MA, GALVICON, by Southern Coatings, Sumter, SC, or equal as approved in accordance with Section 01600 for substitutions.
- I.** Stainless Steel: ASTM A167; Minimum 16 Gage, Type 304, No. 4 Finish.
- J.** Welding Materials: AWS A5.1, E70XX, type and procedures required by electrode manufacturer for materials being welded.
- K.** Grout: ASTM C1107, Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 8,000 psi at 7 days; of consistency suitable for application and a 30 minute working time.

**SECTION 05500  
METAL FABRICATIONS**

**2.2 FABRICATION**

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

**2.3 FINISHES**

- A.** Clean surfaces of rust, scale, grease and foreign matter prior to finishing.
- B.** Do not prime surfaces in direct contact with concrete or where field welding is required.
- C.** Prime paint items with two coats in accordance with requirements of SSPC-21.
- D.** Galvanize steel items to a zinc coating thickness in accordance with ASTM A123.  
  
Surfaces shall be free of icicles, spangles and puddling. Vent all enclosed spaces. See drawings and schedules for extent of steel items to be provided with a galvanized finish.

**Part 3 EXECUTION**

**3.1 EXAMINATION**

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

**3.2 PREPARATION**

**SECTION 05500  
METAL FABRICATIONS**

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

**3.3        INSTALLATION**

- A.** Install items plumb and level, accurately fitted, free from distortion or defects.
- B.** Allow for erection loads and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C.** Field weld components indicated on shop drawings.
  - (1)** Weld joints using shielded electric arc method. Use coated welded rods, not fluxed, or type recommended by manufacturer for use with parent metal.  
Use only certified welders for structural construction.
  - (2)** Grinding: Grind welds on surfaces subject to traffic or contact to smooth flush joints.
  - (3)** Peening: Remove flux and weld spatter as necessary to eliminate unsightly conditions and grind off sharp projections.
  - (4)** Permanently Concealed Welds: No treatment required other than preparation for painting or galvanizing.
- D.** Perform field welding in accordance with AWS D1.1.
- E.** Obtain Architect approval prior to site cutting or making adjustments not scheduled.
- F.** After erection, prime welds, abrasions and surfaces not shop primed except surfaces to be in contact with concrete.

**3.4        ERECTION TOLERANCE**

- A.** Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B.** Maximum Offset From True Alignment: 1/4 inch.

**3.5        SCHEDULE**

- A.** The Schedule is a list of principal items only. Refer to Drawing details for items not specifically scheduled.

**SECTION 05500  
METAL FABRICATIONS**

- B.** Fasteners: Provide fasteners and connectors of approved types, whether indicated or not.
- C.** Bumper Posts and Guard Rails: As detailed; galvanized finish.
- D.** Door Frames for Overhead Door Openings and Wall Openings: Channel sections; galvanized finish.
- E.** Steel Backing Plates: 1/4 inch thick x widths and lengths required to support plumbing fixture hanger and equipment. Cope studs and weld plates flush to surface with continuous welds.
- F.** Steel Corner Guards: Provide steel angle corner guards as detailed, complete with weld-on anchors. Hot dip galvanized after fabrication.
- G.** Grates and Frames: Provide all gratings, covers and frames for catch basins, trench and storm drains. All work shall be galvanized or cast iron. Provide heavy-duty traffic trench type gratings, covers and frames in all traffic areas; manufactured by Alhambra Foundry Co., Alhambra, CA, McKinley Iron Works, Fort Worth, TX, or Neenah Foundry Co., Neenah, WI., or equal as approved in accordance with Section 01600 for substitutions.
  - (1)** Gratings in traffic areas shall be narrow slot type, with openings not greater than 1/2" with direction of slots placed perpendicular to direction of traffic.
  - (2)** Covers shall be provided with recessed bolt attachment to frame.

**END OF SECTION**

## **SECTION 05 52 13 - PIPE AND TUBE RAILINGS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Wall mounted handrails.
- B. Stair railings and guardrails.
- C. Free-standing railings at steps.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Placement of anchors in concrete.
- B. Section 09 91 13 - Exterior Painting: Paint finish.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.
- B. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2020.

#### **1.04 SUBMITTALS**

- A. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

### **PART 2 PRODUCTS**

#### **2.01 RAILINGS - GENERAL REQUIREMENTS**

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.
- B. Allow for expansion and contraction of members and building movement without damage to connections or members.
- C. Dimensions: See drawings for configurations and heights.
- D. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
- E. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

#### **2.02 STEEL RAILING SYSTEM**

- A. Steel Tube: ASTM A500/A500M, Grade B cold-formed structural tubing.
- B. Steel Pipe: ASTM A53/A53M, Grade B Schedule 80, black finish.
- C. Non-Weld Mechanical Fittings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.
- D. Exposed Fasteners: No exposed bolts or screws.

#### **2.03 FABRICATION**

- A. Accurately form components to suit specific project conditions and for proper connection to building structure.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive work.

### **3.02 PREPARATION**

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

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Anchor railings securely to structure.

**END OF SECTION**

## **SECTION 06100 ROUGH CARPENTRY**

### **Part 1 GENERAL**

#### **1.1 WORK INCLUDED**

- A.** Rough Carpentry Work.
- B.** Installation of glued laminate members, plywood web joists or wood chord metal web joist.
- C.** Related Sections:
  - 1.** Section 01455: Testing and Inspection.
  - 2.** Section 03100: Concrete Form Work.
  - 3.** Section 03300: Concrete.
  - 4.** Section 06200: Finish Carpentry .
  - 5.** Section 09260: Gypsum Board.

#### **1.2 REFERENCES**

- A.** Regulatory Requirements:
  - 1.** Work of this Section shall comply with Part 2, Volume 2, CBC Chapter 23A.

#### **1.3 QUALITY ASSURANCE**

- A.** Comply with the Following as a minimum requirement:
  - 1.** Redwood structural and framing lumber shall be graded in accordance with Standard Specifications for Grades of California Redwood Lumber or the Redwood Inspection Service.
  - 2.** Douglas Fir, larch or hemlock structural and framing lumber shall be graded in accordance with the Standard Grading Rules of the West Coast Lumber Inspection Bureau (WCLIB) or the Western Lumber Grading Rules of the Western Wood Products Association (WWPA).
  - 3.** Plywood shall conform to requirements of Product Standard PS 1-95, and shall be grade marked by a recognized grading agency (APA and PTL).

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ROUGH CARPENTRY**

- B.** Lumber shall bear official grade mark of the association under whose rules it was graded or official frame mark of another recognized grading agency.
- C.** Structural and framing members 2 inches and thickness and larger shall be air-dried to a moisture content not to exceed 19 percent before installation.
- D.** Each piece of preservative treated shall be identified by the Quality Mark of an approved inspection agency in accordance with Part 2, Volume 2 CBC Chapter 23A; refer to Section 01455: Testing and Inspection.
- E.** Lumber showing visible signs of mold growth:
  - 1.** Any lumber showing visible signs of mold growth shall be removed from the project site or cleaned as outline below.
  - 2.** The contractor is responsible for all costs associated with cleaning, post-cleaning testing, and reporting for the lumber with mold.
    - a.** Lumber that shows visible signs of mold growth prior to, or after installation, shall be cleaned pursuant to USEPA's guidance publication "Mold Remediate in Schools and Commercial Buildings" dated March 2001 (EPA 402-K-01.001).
    - b.** A minimum of 10% of the total locations cleaned must be sample (tape lift method) post cleaning to ensure cleaning effort was successful results evaluated by direct microscopic examination determine that the general abundance of mold is non-detect or rare (normal trapping to 1+).
    - c.** A report by a Certified Industrial Hygienist (CIH) that details the sampling and cleaning results shall be prepared and submitted to the Owner Authorized Representative (OAR) for review and approval of FUSD.
    - d.** Cleaned lumber shall not be installed or enclosed by finish materials until approval of test results. Cleaned lumber must meet moisture content



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requirements as required elsewhere in this specification prior to installation or application of finishes.

**1.4 SUBMITTALS**

- A.** Submit product data and current ICBO Evaluation Reports for framing anchors.

**1.5 DELIVERY, STORAGE AND HANDLING**

- A.** Do not deliver rough carpentry items until site conditions are adequate to receive the work. Protect items from weather while in transit.
- B.** Store lumber and plywood at the site under cover or otherwise protected against exposure to weather, raise above ground and out of contact with damp or wet surfaces. Stack lumber and plywood and provide for air circulation within and around stacks and under temporary covers. For pressure treated lumber and plywood, provide spacers between courses to permit air circulation.

**1.6 PROJECT CONDITIONS**

- A.** Cooperate with other trades in coordinating their work with the work of this section. Provide wood grounds, blocking and nailers where indicated or as required for work of other trades.

**1.7 STORAGE, HANDLING AND PROTECTION**

- A.** The materials supplied as part of the Work of this section shall be protected from exposure to inclement weather before being covered by other Work.

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**Part 2 PRODUCTS**

**2.1 MATERIALS**

**A.** Lumber: Structural and framing lumber shall be of the following species and grades:

INSTALLATION	SPECIES	GRADE
<b>1.</b> Subfloor, wall sheathing, roof sheathing and ceiling furring	Douglas fir and larch	Construction Board WCLB; WWPA
<b>2.</b> Posts, (5" x 5" and larger, width not more than 2" greater than thickness.)	Douglas fir and larch	No. 1 Structural Posts and Timbers, WCLB. No. 1 Post and Timbers, WWPA
<b>3.</b> Beams, girders and truss members (5" and thicker, rectangular, width	Douglas fir and larch	Select Structural Beams and Stringers, WCLIB;
<b>4.</b> Items in subparagraph 3 when concealed. WCLIB No. 1 Beams	Douglas fir and larch	No. 1 Structural Beams and Stringers
<b>5.</b> Joist, rafters, lintels, posts, mullions and members (2' to 4'	Douglas fir and larch	Construction Light Framing WCLIB; WWPA
<b>6.</b> Other lumber (2" to 4" thick, 2" to 4" wide) not specified in	Douglas fir and larch	Construction Light Framing WCLIB; WWPA
<b>7.</b> Framing lumber (2" to 4" thick, 5" wider).	Douglas fir and larch	No. 1 Structural Joists and Planks, WCLIB; WWPA
<b>8.</b> Mudills and plates in contact with earth	Douglas fir and larch	Same as subparagraphs 6 and 7.
<b>9.</b> Sills or plates installed on concrete or masonry surfaces 6" or less	Douglas fir and larch	Same as subparagraphs 6 and 7.
<b>10.</b> Sills, foundation plates & sleepers Installed on concrete, masonry	Douglas fir and larch	Same as subparagraphs 6 and 7
<b>11.</b> Miscellaneous nailing strips and blocks embedded in concrete or	Douglas fir and larch	Same as subparagraphs 6 and 7

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- B.** Plywood: Plywood furnished for structural purposes, when exposed outdoors, shall be exterior type plywood. Other plywood furnished for structural purposes shall be exterior type, or Exposure 1.
- C.** OSB Board or Panels:
- 1.** Oriented strand board or panels shall not be furnished a part of the Work of this section.
- D.** Preservative Treated Wood:
- 1.** Wood and plywood specified: as treated wood shall be pressure treated wood in accordance with CBC requirements.
  - 2.** Seasoning: Treated lumber shall be air seasoned after treatment, for a minimum of 2 weeks before installation. Moisture content shall be 15 percent maximum.
  - 3.** Creosote or arsenic is not permitted for treating wood.
  - 4.** When treated wood member have been notched, dapped, drilled, or cut, such newly cut surfaces shall be painted with a heavy coat of the same preservative material originally provided for treatment of wood member.
- E.** Fire Retardant Protection: Wood and plywood specified as fire retardant protected wood shall be treated by approved methods and materials and shall be dried following treatment to maximum moisture content as follows:
- 1.** Solid sawn lumber 2" in thickness or less: 19 percent.
  - 2.** Plywood: 15 percent.
- F.** Plywood Subflooring: Underlayment, Group 1 Exposure 1; of thickness indicated.
- G.** Mineral Fiber Panels: Asbestos-free, thickness as indicated.
- H.** Adhesive: Tec, Inc. Sturdi-Bond TA-0175, or Top Industrial Inc., Rainbuster 345, elastomeric adhesive conforming to ASTM D3498 and APA-AFG-01.

**PART 3 – EXECUTION**

**SECTION 06100  
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**3.1 FASTENINGS**

- A.** Nails, Spikes and Staples: Section 2311A, CBC Galvanized for exterior applications, high humidity locations and treated wood; plain finish for other interior locations; size and type to suit application. Comply with Table 23-1-Q, CBC. Use common nails only.
- B.** Bolts, Nuts, Washers, Lags, Pins and Screws: Section 2311A, CBC, sized to suit application, galvanized for exterior locations, high humidity locations and treated wood, plain finish for other interior locations. When lags bear on wood, they shall be fitted with a standard steel plate washer under head. Lags in a wood member are to be screwed in and the hole is to be pre-drilled. Wood screws being installed per CBC are to have a pilot hole/pre-drill.
- C.** Fasteners: Expansion type or powder actuated type for anchorage to solid masonry or concrete. Refer to Section 01400 for acceptable types and required testing.
- D.** Stock Framing Connectors: Section 2311A, CBC types indicated on drawings, galvanized, with nails fully driven in all holes in each face of connector.
  - (1)** Manufacturers:
    - a. Simpson Strong Tie Co., Inc., San Leandro, CA.
    - b. Harlen Metal Products, Compton, CA.
    - c. Silver Metal Products, Livermore, CA.
    - d. Teco Co., Germantown, MD.
    - e. K.C. Metals, Riverside, CA.
  - (2)** Or equal as approved in accordance with Section 01600 for substitutions.
- B.** Non-Stock Framing Connectors: Conform to details.
- C.** Preservative (Pressure) Treated Lumber: Section 2303A, CBC Conform to AWPA manual of recommended practice. Use preservative complying with C-2 and C-9. Conform to AQMD, Local Regulations.
  - (1)** Douglas Fir Larch, used as required by Section 2317A, CBC, shall conform to

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the following:

- a. Lumber shall be WWPA or WCLIB grade stamped.
  - b. Lumber shall be No. 1 grade or better unless indicated otherwise on drawings.
- D.** Waterproof Membrane: ASTM D4601; 25 or 28 lb. asphalt saturated glass felt.
- E.** Fire-Retardant Lumber: Chemically treated and pressure impregnated, as defined in Section 703 CBC. Lumber shall be grade stamped by an approved agency at the factory, and shall bear identification indicating the fire performance rating thereof

**3.2           INSTALLATION**

**A.** Framing, Furring, and Stripping

- 1.** Erect wood framing, furring, stripping and nailing members true to lines and levels. Do not deviate from true alignment more than 1/4 inch in 10 feet, non-cumulative.
- 2.** Construct members of continuous pieces of longest possible lengths.
- 3.** Construct and erect required headers and lintels.
- 4.** Double wall framing members at openings over 100 square inches. Space the short members above and below openings in same manner as for walls.
- 5.** Provide double joist headers at joist ends and around openings unless otherwise indicated on drawings. Bridge joists and rafters to conform to Section 2306A.7 CBC and as noted on plans. For pre-manufactured joists, provide bridging in accordance with manufacturer's recommendations.
- 6.** Construct walls with studs of size and spacing indicated. Install single sill member at bottom and double plate at top. Stagger upper and lower members of double plate with joints not less than 4 feet o.c. or as indicated on drawings. Where sill or any wood member contacts concrete or masonry, install pressure treated lumber.
- 7.** Provide one row of solid blocking not less than 2 inch nominal thickness and

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same width of stud at ceiling and floor lines and at spacing not to exceed 8 feet on center vertically. Fit snugly and attach with not less than two 16d nails.

- 8.** Install 3 studs at corners.
- 9.** Conform to Section 2326A.11.7, CBC, where pipes penetrate sills or plates.
- 10.** Cutting and Notching: Conform to Section 2326A.11.9, CBC.
- 11.** Bored Holes: Conform to Section 2326A.11.10, CBC.
- 12.** Conform to Section 708A, California Building Code for fire blocks and draft stops.

**A. PLYWOOD SHEATHING**

- 1.** Thickness as indicated on the drawings.
- 2.** Boundary Nailing: Not less than 3/8 inch from edge, spaced not more than 6 inches on center, unless noted otherwise on drawings.
- 3.** Blocking: Panel edges shall bear on framing members or solid blocking.
- 4.** Minimum Size Vertical Panel: 12 inches wide.
- 5.** Minimum Size Horizontal Panel: 24 inches wide.

**A. FOUNDATION FRAMING, PLATES, SILLS AND SLEEPERS**

- 1.** Preservative treated wood required.
- 2.** Under-Floor Clearance for Joist: 18 inches minimum.
- 3.** Under-Floor Clearance for Girders: 12 inches minimum.
- 4.** End Clearance for Lumber Entering Concrete: 1/2 inch minimum.

**A HORIZONTAL FRAMING**

- 1.** Bearing: 1-1/2 inch minimum on wood or metal, 3 inches on masonry. Lay framing members with crown up. Members with knots at bottom not permitted.
- 2.** Lateral Support: Use solid blocking, cross bridging or other approved means.
- 3.** Lap joists a minimum of 3 inches when framed from opposite sides of a

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beam. Do not run joists continuous beyond one span unless indicated otherwise on drawings.

- 4.** Openings: Double joists required for trimmer and headers for openings 4 ft. or larger unless indicated otherwise on drawings.
- 5.** Provide ties, purlins and blocking in conformance with Section 2326A, CBC.

**A. BACKING**

- 1.** Provide backing as indicated on drawings or per manufactures recommendation to support electrical fixtures, fixed equipment, cabinets, grab bars, door stops and plates. Fasten securely to framing.

**3.7 CLEAN UP**

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

**3.8 PROTECTION**

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

**END OF SECTION**

## **SECTION 06 41 00 - ARCHITECTURAL WOOD CASEWORK**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Specially fabricated cabinet units.
- B. Countertops.
- C. Hardware.
- D. Factory finishing.
- E. Preparation for installing utilities.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 12 36 00 - Countertops.

#### **1.03 REFERENCE STANDARDS**

- A. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).
- B. BHMA A156.9 - American National Standard for Cabinet Hardware; 2015.

#### **1.04 SUBMITTALS**

- A. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
- B. Product Data: Provide data for hardware accessories.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Protect units from moisture damage.

#### **1.06 FIELD CONDITIONS**

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

### **PART 2 PRODUCTS**

#### **2.01 CABINETS**

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets: Custom grade.

#### **2.02 WOOD-BASED COMPONENTS**

- A. Wood fabricated from old growth timber is not permitted.

#### **2.03 LAMINATE MATERIALS**

- A. Manufacturers:
  - 1. Formica Corporation: [www.formica.com/#sle](http://www.formica.com/#sle).
  - 2. Wilsonart LLC: [www.wilsonart.com/#sle](http://www.wilsonart.com/#sle).
  - 3. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.04 COUNTERTOPS**

- A. Countertops are specified in Section 12 36 00.

#### **2.05 ACCESSORIES**

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Fasteners: Size and type to suit application.
- C. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.



## **2.06 HARDWARE**

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.
- C. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers.
- D. Drawer Slides:
  - 1. Static Load Capacity: Commercial grade.
  - 2. Mounting: Side mounted.
- E. Hinges: European style concealed self-closing type, steel with nickel-plated finish.

## **2.07 FABRICATION**

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

## **2.08 SHOP FINISHING**

- A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

### **3.02 INSTALLATION**

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Secure cabinets to floor using appropriate angles and anchorages.

### **3.03 ADJUSTING**

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

### **3.04 CLEANING**

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

**END OF SECTION**

## **SECTION 06 42 00 - WOOD PANELING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Custom wood veneer paneling.
- B. Shop finishing.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Grounds and concealed blocking.
- B. Section 09 91 23 - Interior Painting: Field finishing.

#### **1.03 REFERENCE STANDARDS**

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).
- C. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2016.

#### **1.04 SUBMITTALS**

- A. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Protect work from moisture damage.
- B. Do not deliver wood materials to project site until building is fully enclosed and interior temperature and humidity are in accordance with recommendations of AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

### **PART 2 PRODUCTS**

#### **2.01 PANELING**

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless otherwise indicated.

#### **2.02 WOOD-BASED MATERIALS - GENERAL**

- A. Hardwood Plywood: HPVA HP-1 Grade A; veneer core, type of glue recommended for application; of grain quality suitable for transparent finish.

#### **2.03 ADHESIVES AND FASTENERS**

- A. Adhesives: Type suitable for intended purpose, complying with applicable air quality regulations.

#### **2.04 FABRICATION**

- A. Prepare panels for delivery to site, permitting passage through building openings.
- B. Finish exposed edges of panels as specified by grade requirements.

#### **2.05 SHOP FINISHING**

- A. Sand work smooth and set exposed nails and screws.
- B. Apply wood filler in exposed nail and screw indentations.
- C. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

#### **2.06 ACCESSORIES**

- A. Lumber for Shimming, Blocking: Softwood lumber of Fir species.
- B. Wood Filler: Tinted to match surface finish color.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated on shop drawings.
- B. Verify adequacy of backing and support framing.
- C. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

### **3.02 INSTALLATION**

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Do not begin installation until wood materials have been fully acclimated to interior conditions.
- C. Set and secure materials and components in place, plumb and level, using concealed fasteners wherever possible.

**END OF SECTION**

## **SECTION 07 21 00 - THERMAL INSULATION**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Batt insulation in exterior wall construction.
- B. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Supporting construction for batt insulation.
- B. Section 07 25 00 - Weather Barriers: Separate air barrier and vapor retarder materials.
- C. Section 09 21 16 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- C. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C; 2019a.

#### **1.04 SUBMITTALS**

- A. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

#### **1.05 FIELD CONDITIONS**

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

### **PART 2 PRODUCTS**

#### **2.01 APPLICATIONS**

- A. Insulation in Wood Framed Walls: Batt insulation with no vapor retarder.

#### **2.02 BATT INSULATION MATERIALS**

- A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option.
- B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
  - 1. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
  - 2. Manufacturers:
    - a. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - b. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
    - c. Owens Corning Corporation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
  - 1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
  - 2. Manufacturers:
    - a. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
    - b. Knauf Insulation: [www.knaufinsulation.com/#sle](http://www.knaufinsulation.com/#sle).
    - c. ROCKWOOL (ROXUL, Inc): [www.rockwool.com/#sle](http://www.rockwool.com/#sle).
    - d. Thermafiber, Inc: [www.thermafiber.com/#sle](http://www.thermafiber.com/#sle).

- e. Substitutions: See Section 01 60 00 - Product Requirements.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of irregularities or materials or substances that may impede adhesive bond.

#### **3.02 BATT INSTALLATION**

- A. Install insulation in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

#### **3.03 PROTECTION**

- A. Do not permit installed insulation to be damaged prior to its concealment.

**END OF SECTION**

## **SECTION 07 25 00 - WEATHER BARRIERS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Water-Resistive Barrier: Under exterior wall cladding, over sheathing or other substrate; not air tight or vapor retardant.
- B. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Water-resistive barrier under exterior cladding.
- B. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.
- C. Section 07 92 00 - Joint Sealants: Sealing building expansion joints.
- D. Section 09 21 16 - Gypsum Board Assemblies: Water-resistive barrier under exterior cladding.

#### **1.03 DEFINITIONS**

- A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.
- B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.
- C. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture resistant, to the degree specified, intended to be installed to shed water without sealed seams.

#### **1.04 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- B. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- C. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.
- D. ICC-ES AC308 - Acceptance Criteria for Water-Resistive Barriers; 2016.

#### **1.05 SUBMITTALS**

- A. Product Data: Provide data on material characteristics.
- B. Shop Drawings: Provide drawings of special joint conditions.

#### **1.06 FIELD CONDITIONS**

- A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

### **PART 2 PRODUCTS**

#### **2.01 WEATHER BARRIER ASSEMBLIES**

- A. Water-Resistive Barrier: Provide on exterior walls under exterior cladding.
  - 1. Use building paper unless otherwise indicated.
  - 2. Under Portland cement stucco, use two separate layers of building paper.
  - 3. Under siding, use two separate layers of building paper.
- B. Air Barrier:
  - 1. On outside surface of sheathing of exterior walls use air barrier sheet, mechanically fastened type.

#### **2.02 WATER-RESISTIVE BARRIER MATERIALS (NEITHER AIR BARRIER OR VAPOR RETARDER)**

- A. Building Paper: Asphalt-saturated Kraft building paper complying with requirements of ICC-ES AC308 Grade D.

## **2.03 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)**

- A. Air Barrier Sheet, Mechanically Fastened:
  - 1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
  - 2. Water Vapor Permeance: 5 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (Desiccant Method) at 73.4 degrees F.
  - 3. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 180 days of weather exposure.
  - 4. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, when tested in accordance with ASTM E84.
  - 5. Seam and Perimeter Tape: Polyethylene self adhering type, mesh reinforced, 2 inches wide, compatible with sheet material; unless otherwise specified.

## **2.04 ACCESSORIES**

- A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces and conditions are ready to accept the work of this section.

### **3.02 PREPARATION**

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- B. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

### **3.03 INSTALLATION**

- A. Install materials in accordance with manufacturer's instructions.
- B. Water-Resistive Barriers: Install continuous barrier over surfaces indicated, with sheets lapped to shed water but with seams not sealed.
- C. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- D. Mechanically Fastened Sheets - On Exterior:
  - 1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
  - 2. Overlap seams as recommended by manufacturer but at least 6 inches.
  - 3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches.
  - 4. For applications specified to be air tight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners recommended by the manufacturer.
  - 5. Install water-resistive barrier over jamb flashings.
  - 6. Install air barrier and vapor retarder underneath the jamb flashings.
  - 7. Install head flashings under weather barrier.
  - 8. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.
- E. Openings and Penetrations in Exterior Weather Barriers:
  - 1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
  - 2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
  - 3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.

4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

#### **3.04 PROTECTION**

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.
- B. Do not leave paper- or felt-based barriers exposed to weather for longer than one week.

**END OF SECTION**



## **SECTION 07 51 00 - BUILT-UP BITUMINOUS ROOFING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Built-up roofing membrane, conventional and protected membrane application.
- B. Base flashings.
- C. Roofing cant strips, accessories, roofing expansion joints, roofing vents, and walkways.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Wood nailers and curbs.
- B. Section 07 62 00 - Sheet Metal Flashing and Trim: Counterflashings, reglets and \_\_\_\_\_.
- C. Section 07 72 00 - Roof Accessories: Roof-mounted units.

#### **1.03 REFERENCE STANDARDS**

- A. NRCA (RM) - The NRCA Roofing Manual; 2019.

#### **1.04 SUBMITTALS**

- A. Product Data: Provide data indicating membrane and bitumen materials, base flashing materials, insulation, vapor retarder, and surfacing.
- B. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, and setting plan for tapered insulation.
- C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.
- B. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

#### **1.06 FIELD CONDITIONS**

- A. Do not apply roofing membrane during unsuitable weather.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 110 degrees F.
- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

#### **1.07 WARRANTY**

- A. Correct defective work within a two year period after Date of Substantial Completion.
- B. Provide ten year manufacturer's material and labor warranty to cover failure to prevent penetration of water.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Sheet and Bitumen Materials:
  - 1. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 2. GAF: [www.gaf.com/#sle](http://www.gaf.com/#sle).
  - 3. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.02 ROOFING - CONVENTIONAL APPLICATION**

- A. Built-up Bituminous Roofing: Asphalt felt membrane, four ply plus base sheet, with vapor retarder and insulation.

## **2.03 ACCESSORIES**

- A. Roofing Expansion Joint Flashing: Sheet butyl.
- B. Cant Strips: Wood; pressure preservative treated.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

### **3.02 INSTALLATION - VAPOR RETARDER, CONVENTIONAL**

- A. Mopped Two-Ply Base Sheet/Vapor Retarder:
  - 1. Apply coat of primer by roller on top of flute surfaces. Allow to dry. Apply ribbon mop of bitumen to top of flute surfaces.
  - 2. Apply bitumen at rate of 20 lbs/square (100 sq ft).
  - 3. Embed one ply of base sheet; lap plies 4 inches; seal joints with bitumen.
  - 4. Mop bitumen glaze coat over base sheet at a rate of 10 lbs/square (100 sq ft) and embed one ply of vapor retarder felt; lap edges 4 inches; seal joints with bitumen.
- B. Extend vapor retarder under cant strips and blocking.

### **3.03 INSTALLATION - MEMBRANE**

- A. Install built-up bituminous roofing system in accordance with manufacturers recommendations and NRCA (RM) applicable requirements.
- B. Equiviscous Temperature (EVT) at Point of Application: Comply with NRCA (RM) recommendations.
- C. Apply membrane plies, weather lap edges and ends, and mop with 20 lbs/square (100 sq ft) of bitumen per ply. Apply plies 2 on 2 in same direction.
- D. Apply smooth, free from air pockets, wrinkles, fish-mouths, or tears.
- E. At end of day's operation, install two plies membrane and bitumen glaze coat for cut-off. Glaze exposed felts. Remove cut-off before resuming roofing.
- F. At intersections with vertical surfaces:
  - 1. Extend membrane and base sheet over cant strips and up a minimum of 4 inches onto vertical surfaces.
  - 2. Mop on base flashing of two additional plies of felt and one ply of base flashing material.
- G. Around roof penetrations, mop in and seal flanges and flashings with two additional plies of felt.
- H. Install roofing expansion joints where indicated. Make joints watertight.
- I. Coordinate installation of roof drains and related flashings.

### **3.04 CLEANING**

- A. Remove bituminous markings from finished surfaces.
- B. In areas where finished surfaces are soiled by bitumen or other source of soiling caused by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

- C. Repair or replace defaced or damaged finishes caused by work of this section.

### **3.05 PROTECTION**

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

**END OF SECTION**

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

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Fabricated sheet metal items, including flashings, counterflashings, and exterior penetrations.
- B. Sealants for joints within sheet metal fabrications.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Wood nailers for sheet metal work.
- B. Section 07 72 00 - Roof Accessories: Manufactured metal roof curbs.
- C. Section 07 92 00 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- C. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).
- D. CDA A4050 - Copper in Architecture - Handbook; current edition.
- E. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

#### **1.04 SUBMITTALS**

- A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

#### **1.05 QUALITY ASSURANCE**

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

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

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

### **PART 2 PRODUCTS**

#### **2.01 SHEET MATERIALS**

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gauge, (0.0239 inch) thick base metal.

#### **2.02 FABRICATION**

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- F. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

#### **2.03 ACCESSORIES**

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer: Zinc chromate type.

- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- E. Plastic Cement: ASTM D4586/D4586M, Type I.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

#### **3.02 PREPARATION**

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

#### **3.03 INSTALLATION**

- A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

**END OF SECTION**

## **SECTION 07 72 00 - ROOF ACCESSORIES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Curbs.

#### **1.02 SUBMITTALS**

- A. Product Data: Manufacturer's data sheets on each product to be used.
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
  - 4. Maintenance requirements.
- B. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.

#### **1.03 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.

### **PART 2 PRODUCTS**

#### **2.01 ROOF CURBS**

- A. Manufacturers:
  - 1. AES Industries Inc: [www.aescurb.com/#sle](http://www.aescurb.com/#sle).
  - 2. The Pate Company: [www.patecurbs.com/#sle](http://www.patecurbs.com/#sle).
  - 3. LMCurbs: [www.lmcurbs.com/#sle](http://www.lmcurbs.com/#sle).
  - 4. MKT Metal Manufacturing: [www.mktduct.com/#sle](http://www.mktduct.com/#sle).
  - 5. Roof Products & Systems (RPS): [www.rpscurbs.com/#sle](http://www.rpscurbs.com/#sle).
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
  - 1. Roof Curb Mounting Substrate: Curb substrate consists of flat roof deck sheathing with insulation.
  - 2. Sheet Metal Material:
    - a. Aluminum: 0.080 inch minimum thickness, with 3003 alloy, and H14 temper.
  - 3. Provide layouts and configurations indicated on drawings.
- C. Curbs Adjacent to Roof Openings: Provide curb on each side of opening, with top of curb horizontal for equipment mounting.
  - 1. Provide preservative treated wood nailers along top of curb.
  - 2. Insulate inside curbs with 1-1/2 inch thick fiberglass insulation.
  - 3. Height Above Finished Roof Surface: 8 inches, minimum.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

### **3.04 CLEANING**

- A. Clean installed work to like-new condition.

### **3.05 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

## **SECTION 07 92 00 - JOINT SEALANTS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Nonsag gunnable joint sealants.
- B. Joint backings and accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 25 00 - Weather Barriers: Sealants required in conjunction with air barriers and vapor retarders.
- B. Section 08 71 00 - Door Hardware: Setting exterior door thresholds in sealant.
- C. Section 08 80 00 - Glazing: Glazing sealants and accessories.
- D. Section 09 30 00 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- B. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- C. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2018.
- D. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).

#### **1.04 SUBMITTALS**

- A. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
  - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
  - 2. List of backing materials approved for use with the specific product.
  - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
  - 4. Substrates the product should not be used on.
- B. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

#### **1.05 WARRANTY**

- A. Correct defective work within a five year period after Date of Substantial Completion.
- B. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
  - 1. Bostik Inc: [www.bostik-us.com/#sle](http://www.bostik-us.com/#sle).
  - 2. Dow Chemical Company: [consumer.dow.com/en-us/industry/ind-building-construction.html/#sle](http://consumer.dow.com/en-us/industry/ind-building-construction.html/#sle).
  - 3. Hilti, Inc: [www.us.hilti.com/#sle](http://www.us.hilti.com/#sle).
  - 4. QUIKRETE Companies: [www.quikrete.com/#sle](http://www.quikrete.com/#sle).
  - 5. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
  - 6. Sika Corporation: [www.usa-sika.com/#sle](http://www.usa-sika.com/#sle).
  - 7. Tremco Commercial Sealants & Waterproofing: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
  - 8. W.R. Meadows, Inc: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
  - 9. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.02 JOINT SEALANT APPLICATIONS**

- A. Scope:



1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
    - a. Wall expansion and control joints.
    - b. Joints between door, window, and other frames and adjacent construction.
    - c. Joints between different exposed materials.
    - d. Openings below ledge angles in masonry.
    - e. Other joints indicated below.
  2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
    - a. Joints between door, window, and other frames and adjacent construction.
    - b. Other joints indicated below.
  3. Do not seal the following types of joints.
    - a. Intentional weepholes in masonry.
    - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
    - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
    - d. Joints where installation of sealant is specified in another section.
    - e. Joints between suspended panel ceilings/grid and walls.
- B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
- C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
- D. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

## **2.03 JOINT SEALANTS - GENERAL**

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

## **2.04 NONSAG JOINT SEALANTS**

- A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
  2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
  3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
  4. Color: To be selected by Architect from manufacturer's standard range.
- B. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
- C. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: White.
- D. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.

## **2.05 ACCESSORIES**

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

- C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

#### **3.02 PREPARATION**

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

#### **3.03 INSTALLATION**

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Install bond breaker backing tape where backer rod cannot be used.
- D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- E. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- F. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

**END OF SECTION**

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

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 08 71 00 - Door Hardware.
- B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.
- C. Section 09 91 13 - Exterior Painting: Field painting.
- D. Section 09 91 23 - Interior Painting: Field painting.

#### **1.03 REFERENCE STANDARDS**

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2018.
- G. 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; 2018a.
- H. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- I. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2007.

#### **1.04 SUBMITTALS**

- A. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- B. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

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

5. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.02 PERFORMANCE REQUIREMENTS**

- A. Requirements for Hollow Metal Doors and Frames:
  - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
  - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

## **2.03 HOLLOW METAL DOORS**

- A. Door Finish: Factory primed and field finished.
- B. Interior Doors, Non-Fire-Rated:
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 1 - Standard-duty.
    - b. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 1 - Full Flush.
    - d. Door Face Metal Thickness: 20 gauge, 0.032 inch, minimum.
  - 2. Door Thickness: 1-3/4 inches, nominal.

## **2.04 HOLLOW METAL FRAMES**

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
- D. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

## **2.05 FINISHES**

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

## **2.06 ACCESSORIES**

- A. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- B. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

### **3.02 INSTALLATION**

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Install door hardware as specified in Section 08 71 00.
- D. Touch up damaged factory finishes.

### **3.03 TOLERANCES**

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

### **3.04 ADJUSTING**

- A. Adjust for smooth and balanced door movement.

### **3.05 SCHEDULE**

- A. Refer to Door and Frame Schedule on the drawings.

**END OF SECTION**

## **SECTION 08 14 16 - FLUSH WOOD DOORS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Flush wood doors; flush configuration; non-rated.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 08 11 13 - Hollow Metal Doors and Frames.
- B. Section 08 71 00 - Door Hardware.
- C. Section 08 80 00 - Glazing.
- D. Section 09 91 23 - Interior Painting: Field finishing of doors.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- B. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

#### **1.04 SUBMITTALS**

- A. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- B. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- C. Warranty, executed in Owner's name.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

#### **1.06 WARRANTY**

- A. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

### **PART 2 PRODUCTS**

#### **2.01 DOORS AND PANELS**

- A. Doors: See drawings for locations and additional requirements.
  - 1. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
  - 1. Provide solid core doors at each location.

#### **2.02 DOOR AND PANEL CORES**

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

#### **2.03 DOOR FACINGS**

- A. High Pressure Decorative Laminate (HPDL) Facing for Fire Doors: NEMA LD 3, SGF; color to match existing, selected from standard finishes; textured, low gloss finish.

#### **2.04 DOOR CONSTRUCTION**

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:

- C. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- F. Provide edge clearances in accordance with the quality standard specified.

## **2.05 ACCESSORIES**

- A. Hollow Metal Door Frames: See Section 08 11 13.
- B. Glazed Openings:
  - 1. Heat-Strengthened and Fully Tempered Glass: ASTM C1048.
- C. Door Window Frames: Door window frames with glazing securely fastened within door opening.
- D. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

### **3.02 INSTALLATION**

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

### **3.03 TOLERANCES**

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

### **3.04 ADJUSTING**

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

**END OF SECTION**

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

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Wall and ceiling mounted access units.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 09 91 13 - Exterior Painting: Field paint finish.
- B. Section 09 91 23 - Interior Painting: Field paint finish.

#### **1.03 REFERENCE STANDARDS**

#### **1.04 SUBMITTALS**

- A. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- B. Shop Drawings: Indicate exact position of each access door and/or panel unit.

### **PART 2 PRODUCTS**

#### **2.01 ACCESS DOORS AND PANELS ASSEMBLIES**

#### **2.02 WALL AND CEILING MOUNTED ACCESS UNITS**

- A. Manufacturers:
  - 1. ACUDOR Products Inc: [www.acudor.com/#sle](http://www.acudor.com/#sle).
  - 2. Babcock-Davis: [www.babcockdavis.com/#sle](http://www.babcockdavis.com/#sle).
  - 3. Best Access Doors: [www.bestaccessdoors.com/#sle](http://www.bestaccessdoors.com/#sle).
  - 4. Elmdor Stonemen: [www.elmdorstoneman.com/#sle](http://www.elmdorstoneman.com/#sle).
  - 5. Nystrom, Inc: [www.nystrom.com/#sle](http://www.nystrom.com/#sle).
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
  - 1. Material: Aluminum.
  - 2. Door Style: Single thickness with rolled or turned in edges.
  - 3. Aluminum Finish: Natural brushed.
  - 4. Hardware:
    - a. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

#### **3.03 INSTALLATION**

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

### **END OF SECTION**



## **SECTION 08 33 13 - COILING COUNTER DOORS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Non-fire-rated coiling counter doors and operating hardware.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Rough openings.
- B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- C. Section 09 21 16 - Gypsum Board Assemblies: Rough openings.
- D. Section 09 91 13 - Exterior Painting: Field paint finish.
- E. Section 09 91 23 - Interior Painting: Field paint finish.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

#### **1.04 SUBMITTALS**

- A. Product Data: Submit manufacturer's standard literature showing materials and details of construction and finish. Include data on electrical operation.
- B. Shop Drawings: Indicate rough and actual opening dimensions, anchorage methods, hardware locations, and installation details.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Coiling Counter Doors:
  - 1. Alpine Overhead Doors, Inc: [www.alpinedoors.com/#sle](http://www.alpinedoors.com/#sle).
  - 2. C.H.I. Overhead Doors; Model 6522 (steel): [www.chiohd.com/#sle](http://www.chiohd.com/#sle).
  - 3. Raynor Garage Doors: [www.raynor.com/#sle](http://www.raynor.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.02 COILING COUNTER DOORS**

- A. Coiling Counter Doors, Non-Fire-Rated: Aluminum slat curtain.
  - 1. Mounting: Between jambs, within prepared opening.
  - 2. Nominal Slat Size: 1-1/4 inches wide.
  - 3. Slat Profile: Flat, perforated.
  - 4. Finish, Aluminum: Anodized.
  - 5. Guides: Formed track; same material and finish unless otherwise indicated.

#### **2.03 MATERIALS**

- A. Curtain Construction: Interlocking, single thickness slats.
  - 1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
  - 2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
  - 3. Aluminum Slats: ASTM B221 (ASTM B221M), aluminum alloy Type 6063; minimum thickness 0.05 inch.
- B. Guide Construction: Continuous, of profile to retain door in place, with mounting brackets of same metal.
  - 1. Aluminum Guides: Extruded aluminum channel, with wool pile runners along inside.
- C. Lock Hardware:
  - 1. Latch Handle: Manufacturer's standard.
  - 2. Manual Chain Lift: Provide padlockable chain keeper on guide.

- D. Roller Shaft Counterbalance: Steel pipe and torsion steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that opening sizes, tolerances and conditions are acceptable.

#### **3.02 INSTALLATION**

- A. Install units in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Install perimeter trim as indicated.

#### **3.03 TOLERANCES**

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: 1/16 inch.
- C. Maximum Variation From Level: 1/16 inch.
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

#### **3.04 ADJUSTING**

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

#### **3.05 CLEANING**

- A. Clean installed components.
- B. Remove labels and visible markings.

**END OF SECTION**

## **SECTION 08 36 13 - SECTIONAL DOORS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Overhead sectional doors, electrically operated.
- B. Operating hardware and supports.
- C. Electrical controls.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Rough wood framing for door opening.
- B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- C. Section 09 91 13 - Exterior Painting: Finish painting.
- D. Section 09 91 23 - Interior Painting: Finish painting.
- E. Section 26 05 83 - Wiring Connections.

#### **1.03 REFERENCE STANDARDS**

- A. DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors; 2011.
- B. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000, with Errata (2008).
- C. NEMA MG 1 - Motors and Generators; 2018.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

#### **1.04 SUBMITTALS**

- A. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- B. Product Data: Show component construction, anchorage method, and hardware.

#### **1.05 WARRANTY**

- A. Correct defective Work within a five year period after Date of Substantial Completion.
- B. Warranty: Include coverage for electric motor and transmission.
- C. Provide five year manufacturer warranty for electric operating equipment.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Sectional Doors:
  - 1. bp Glass Garage Doors & Entry Systems; Insulated Line, with Model BP-450 HD Full Vision Type Aluminum & Glass Sectional Overhead Doors: [www.glassgaragedoors.com/#sle](http://www.glassgaragedoors.com/#sle).
  - 2. C.H.I. Overhead Doors: [www.chiohd.com/#sle](http://www.chiohd.com/#sle).
  - 3. Clopay Building Products: [www.clopaydoor.com/#sle](http://www.clopaydoor.com/#sle).
  - 4. Raynor Garage Doors: [www.raynor.com/#sle](http://www.raynor.com/#sle).
  - 5. Wayne-Dalton, a Division of Overhead Door Corporation: [www.wayne-dalton.com/#sle](http://www.wayne-dalton.com/#sle).
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.02 STEEL DOORS**

- A. Steel Doors: Flush steel, insulated; standard lift operating style with track and hardware; complying with DASMA 102, Commercial application.

1. Door Nominal Thickness: 2 inches thick.
2. Exterior Finish: Factory finished with acrylic baked enamel; color as selected by Architect.
3. Interior Finish: Factory finished with standard factory finish; color as selected from manufacturers standard line.
4. Glazed Lights: Full panel width, one row; set in place with resilient glazing channel.
5. Electric Operation: Electric control station.

B. Glazing: Fully tempered glass; insulated glass units; clear; 1 inch overall thickness.

### **2.03 COMPONENTS**

- A. Track: Rolled galvanized steel, 0.090 inch minimum thickness; 2 inch wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch thick.
- B. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.
- C. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.
- D. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.
- E. Head Weatherstripping: EPDM rubber seal, one piece full length.
- F. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.
- G. Lock: Inside center mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior and exterior handle.

### **2.04 ELECTRIC OPERATION**

- A. Electric Operators:
  1. Mounting: Side mounted on cross head shaft.
  2. Motor Enclosure:
    - a. Exterior Doors: NEMA MG 1, Type 4; open drip proof.
  3. Motor Rating: 1/3 hp; continuous duty.
  4. Motor Voltage: 120 volts, single phase, 60 Hz.
  5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
  6. Controller Enclosure: NEMA 250, Type 1.
  7. Opening Speed: 12 inches per second.
  8. Brake: Adjustable friction clutch type, activated by motor controller.
  9. Manual override in case of power failure.
  10. Refer to Section 26 05 83 for electrical connections.
- B. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.
- C. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325.
  1. 24 volt circuit.
  2. Surface mounted, at interior door jamb.
  3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
    - a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.
- D. Safety Edge: Located at bottom of sectional door panel, full width; electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object; hollow neoprene covered to provide weatherstrip seal.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
- B. Verify that electric power is available and of the correct characteristics.

### **3.02 PREPARATION**

- A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.
- B. Apply primer to wood frame.

### **3.03 INSTALLATION**

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Anchor assembly to wall construction and building framing without distortion or stress.
- C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- D. Fit and align door assembly including hardware.
- E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

### **3.04 TOLERANCES**

- A. Maximum Variation from Plumb: 1/16 inch.
- B. Maximum Variation from Level: 1/16 inch.
- C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.
- D. Maintain dimensional tolerances and alignment with adjacent work.

### **3.05 ADJUSTING**

- A. Adjust door assembly for smooth operation and full contact with weatherstripping.

### **3.06 CLEANING**

- A. Clean doors and frames and glazing.
- B. Remove temporary labels and visible markings.

### **3.07 PROTECTION**

- A. Protect installed products from damage until Date of Substantial Completion.
- B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

**END OF SECTION**

## **SECTION 08 43 13 - ALUMINUM-FRAMED STOREFRONTS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Aluminum-framed storefront, with vision glass.
- B. Aluminum doors and frames.
- C. Weatherstripping.
- D. Door hardware.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 05 12 00 - Structural Steel Framing: Steel attachment members.
- B. Section 07 25 00 - Weather Barriers: Sealing framing to weather barrier installed on adjacent construction.
- C. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.
- D. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.
- E. Section 08 80 00 - Glazing: Glass and glazing accessories.

#### **1.03 REFERENCE STANDARDS**

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.
- B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

#### **1.04 SUBMITTALS**

- A. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.
- B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- C. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

#### **1.06 FIELD CONDITIONS**

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

#### **1.07 WARRANTY**

- A. Correct defective Work within a five year period after Date of Substantial Completion.
- B. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Aluminum-Framed Storefronts Manufacturers:
  - 1. Arcadia, Inc: [www.arcadiainc.com/#sle](http://www.arcadiainc.com/#sle).
  - 2. Kawneer North America: [www.kawneer.com/#sle](http://www.kawneer.com/#sle).
  - 3. Trulite Glass & Aluminum Solutions, LLC: [www.trulite.com/#sle](http://www.trulite.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.02 ALUMINUM-FRAMED STOREFRONT**

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
  - 1. Glazing Position: Centered (front to back).
  - 2. Finish: Class I color anodized.
    - a. Factory finish all surfaces that will be exposed in completed assemblies.
  - 3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
  - 4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
  - 5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
  - 6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
  - 7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
  - 8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

### **2.03 COMPONENTS**

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
  - 1. Glazing Stops: Flush.
- B. Glazing: As specified in Section 08 80 00.
- C. Swing Doors: Glazed aluminum.
  - 1. Finish: Same as storefront.

### **2.04 MATERIALS**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Fasteners: Stainless steel.
- C. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- D. Glazing Accessories: As specified in Section 08 80 00.

### **2.05 FINISHES**

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

### **2.06 HARDWARE**

- A. For each door, include weatherstripping, sill sweep strip, and threshold.
- B. Other Door Hardware: Storefront manufacturer's standard type to suit application.
  - 1. Finish on Hand-Contacted Items: Polished chrome.

2. For each door, include butt hinges, pull handle, exit device, and closer.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

#### **3.02 INSTALLATION**

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Set thresholds in bed of sealant and secure.
- J. Install hardware using templates provided.
- K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

#### **3.03 ADJUSTING**

- A. Adjust operating hardware and sash for smooth operation.

#### **3.04 CLEANING**

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

#### **3.05 PROTECTION**

- A. Protect installed products from damage until Date of Substantial Completion.

### **END OF SECTION**



## SECTION 08 71 00 – DOOR HARDWARE

### 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. Mechanical door hardware for:
    - a. Swinging doors.
  - 2. Allowances:
    - a. Procure scheduled Best brand temporary and permanent cylinder cores and keys from (Owner's lock shop / Owner's Physical Plant Maintenance Dept). Allow \$45 per core and \$7.50 per key. Owner's agent will purchase the cores and keys directly from Best Access Systems or provide the units from Owner's attic stock.
- B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:
  - 1. Windows
  - 2. Cabinets (casework), including locks in cabinets
  - 3. Signage
  - 4. Toilet accessories
  - 5. Overhead doors
  - 6. Installation.
  - 7. Rough hardware.
  - 8. Conduit, junction boxes & wiring.
  - 9. Folding partitions, except cylinders where detailed.
  - 10. Sliding aluminum doors, except cylinders where detailed.
  - 11. Access doors and panels, except cylinders where detailed.
- C. Related Sections:
  - 1. Division 01 Section "Alternates" for alternates affecting this section.
  - 2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
  - 3. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.

#### 1.3 REFERENCES

- A. UL - Underwriters Laboratories
  - 1. UL 10B - Fire Test of Door Assemblies
  - 2. UL 10C - Positive Pressure Test of Fire Door Assemblies

3. UL 1784 - Air Leakage Tests of Door Assemblies
  4. UL 305 - Panic Hardware
- B. ANSI - American National Standards Institute
1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
- C. California Code of Regulations
1. Title 24: California Building Standards Code

Use date of standard in effect as of Bid date.

BHMA – Builders Hardware Manufacturers Association  
2019 California Building Code

Chapter 11B – Accessibility To Public Buildings, Public Accommodations,  
Commercial Buildings and Public Housing  
NFPA – National Fire Protection Association

NFPA 80 – Standard for Fire Doors and Other Opening Protectives.  
NFPA 105 – Smoke and Draft Control Door Assemblies  
NFPA 252 – Fire Tests of Door Assemblies

UL – Underwriters Laboratories

UL10C – Positive Pressure Fire Tests of Door Assemblies.  
UL 305 – Panic Hardware

#### 1.4 SUBMITTALS

##### A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.

##### B. Action Submittals:

1. Product Data: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
  - a. Wiring Diagrams: For power, signal, and control wiring and including:
    - 1) Details of interface of electrified door hardware and building safety and security systems.
    - 2) Schematic diagram of systems that interface with electrified door hardware.
    - 3) Point-to-point wiring.
    - 4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
  - a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
  - a. Door Index; include door number, heading number, and Architects hardware set number.
  - b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
  - c. Type, style, function, size, and finish of each hardware item.
  - d. Name and manufacturer of each item.
  - e. Fastenings and other pertinent information.
  - f. Location of each hardware set cross-referenced to indications on Drawings.
  - g. Explanation of all abbreviations, symbols, and codes contained in schedule.
  - h. Mounting locations for hardware.
  - i. Door and frame sizes and materials.
  - j. Name and phone number for local manufacturer's representative for each product.
  - k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include how door will operate on egress, ingress, and fire and smoke alarm connection.
    - 1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.
5. Key Schedule:
  - a. Initiate and conduct meeting(s) with Owner representatives and hardware supplier to determine system keyway(s), keybow styles, structure, stamping, degree of physical security 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.
  - b. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
  - c. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
  - d. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
  - e. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
  - f. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
    - 1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:

1. Qualification Data: For Supplier and Installer.

2. Product Certificates for electrified door hardware, signed by manufacturer:
    - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
  3. Certificates of Compliance:
    - a. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in "QUALITY ASSURANCE" article, herein.
  4. Warranty: Special warranty specified in this Section.
- D. Closeout Submittals:
1. Operations and Maintenance Data : Provide in accordance with Division 01 and include:
    - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
    - b. Catalog pages for each product.
    - c. Name, address, and phone number of local representative for each manufacturer.
    - d. Final approved hardware schedule, edited to reflect conditions as-installed.
    - e. Final keying schedule
    - f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
    - g. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

## 1.5 QUALITY ASSURANCE

- A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.
1. Where specific manufacturer's product is named and accompanied by "No Substitute," including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)
    - a. Where no additional products or manufacturers are listed in product category, requirements for "No Substitute" govern product selection.
  2. Where products indicate "acceptable manufacturers" or "acceptable manufacturers and products", provide product from specified manufacturers, subject to compliance with specified requirements and "Single Source Responsibility" requirements stated herein.
- B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project.
1. Scheduling Responsibility: Preparation of door hardware and keying schedules.
  2. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
  3. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.

- C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.
- D. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
  - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
- E. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- F. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
  - 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
- G. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
- H. Means of Egress Doors: Latches do not require more than 5 lbs (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.
- I. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.
  - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbs (22.2 N).
  - 2. Maximum opening-force requirements:
    - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbs (22.2 N) applied perpendicular to door.
    - b. Sliding or Folding Doors: 5 lbs (22.2 N) applied parallel to door at latch.
    - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
  - 3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
  - 4. Adjust door closer sweep periods so that, from open position of 70 degrees, door will take at least 3 seconds to move to 3 inches (75 mm) from latch, measured to leading edge of door.
- J. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01.
  - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 2. Inspect and discuss preparatory work performed by other trades.
  - 3. Inspect and discuss electrical roughing-in for electrified door hardware.
  - 4. Review sequence of operation for each type of electrified door hardware.
  - 5. Review required testing, inspecting, and certifying procedures.
- K. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
  - a. Attendees: Door hardware supplier, door hardware installer, Contractor.
  - b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.
2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.
  - a. Attendees: electrified door hardware supplier, doors and frames supplier, electrified door hardware installer, electrical subcontractor, Owner, Owner's security consultant, Architect and Contractor.
  - b. After meeting, provide letter of compliance to Architect, indicating when coordination conference was held and who was in attendance.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
  1. Deliver each article of hardware in manufacturer's original packaging.
- C. Project Conditions:
  1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
  2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- D. Protection and Damage:
  1. Promptly replace products damaged during shipping.
  2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
  3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- E. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

#### 1.7 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings:
  - 1. Prior to submittal, carefully inspect existing conditions to verify finish hardware required to complete Work, including sizes, quantities, existing hardware scheduled for re-use, and sill condition material. If conflict between the specified/scheduled hardware and existing conditions, submit request for direction from Architect. Include date of jobsite visit in the submittal.
  - 2. Submittals prepared without thorough jobsite visit by qualified hardware expert will be rejected as non-compliant.
- F. Direct shipments not permitted, unless approved by Contractor.

#### 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Years from date of Substantial Completion, for durations indicated.
    - a. Closers:
      - 1) Mechanical: 30 years.
    - b. Exit Devices:
      - 1) Mechanical: 3 years.
  - 2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

#### 1.9 MAINTENANCE

- A. Maintenance Tools:
  - 1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

#### 1.10 REGULATORY REQUIREMENTS:

- A. Locate latching hardware between 34 inches to 44 inches above the finished floor, per 2019 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. 2019 California Building Code Section 11B-309.4.
  - 2. Force required to activate the operable parts: 5.0 pounds maximum, per 2019 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 2019 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. Low-energy powered doors: comply with ANSI/BHMA A156.19. Reference: 2019 California Building Code Section 11B-404.2.9, Exception 2.
  - 1. Where powered door serves an occupancy of 150 or more, provide back-up battery power or stand-by generator power, capable of supporting a minimum of 100 cycles.
  - 2. Actuators, vertical bar type: minimum 2-inches wide, 30-inches high, bottom located minimum 5-inches above floor or ground, top located minimum 35-inches above floor or ground. Displays International Symbol of Accessibility, per 2019 California Building Code Section 11B-703.7.
  - 3. Actuators, plate type: use two at each side of the opening. Minimum 4-inches diameter or 4-inches square. Displays International Symbol of Accessibility, per 2019 California Building Code Section 11B-703.7. Locate centerline of lower plate between 7- and 8-inches above floor or ground, and upper plate between 30- and 44-inches above floor or ground.
  - 4. Actuator location: conspicuously located, clear and level floor/ground space for forward or parallel approach.
- E. 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 2019 California Building Code Section 11B-404.2.8.
  - 1. Spring hinges: adjust for 1.5 seconds minimum for 70 degrees to fully-closed.
- F. Smooth surfaces at bottom 10 inches of push sides of doors, facilitating push-open with wheelchair footrests, per 2019 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.
  - 2. Tempered glass doors without stiles: bottom rail may be less than 10 inches if top leading edge is tapered 60 degrees minimum.
- G. 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. 2019 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 2019 California Building Code 11B-307.4.
- H. Thresholds: floor or landing no more than 0.50 inches below the top of the threshold of the doorway, per 2019 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). 2019 California Building Code Section 11B-303.2 & ~.3.



- I. Floor stops: Do not locate in path of travel. Locate no more than 4 inches from walls, per DSA Policy #99-08 (Access).
- J. 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 2019 California Building Code Section 11B-703.4.2.
- K. Door and door hardware encroachment: when door is swung fully-open into means-of-egress path, the door may not encroach/project more than 7 inches into the required exit width, with the exception of door release hardware such as lockset levers or panic hardware. These hardware items must be located no less than 34-inches and no more than 48-inches above the floor/ground. 2019 California Building Code, Section 1005.7.1.
- L. In I-2 occupancies, latch release hardware is not permitted to project in the required exit width, regardless of its mounting height, per 2019 California Building Code, Section 1005.7.1 at Exception 1.

## PART 2 -

### 2.1 MANUFACTURERS

- A. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturer" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
- C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- D. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- E. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

### 2.2 MATERIALS

- A. Fasteners
  - 1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
  - 2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
  - 3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
  - 4. Install hardware with fasteners provided by hardware manufacturer.

- B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.
  - 1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
  - 2. Use materials which match materials of adjacent modified areas.
  - 3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.
- C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
  - 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

## 2.3 HINGES

### A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product: Ives 3CB series

### B. Requirements:

- 1. Provide three-knuckle ball bearing hinges conforming to ANSI/BHMA A156.1.
- 2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
  - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
  - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
- 3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
  - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
  - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
- 4. 2 inches or thicker doors:
  - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
  - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
- 5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
- 6. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
- 7. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
  - a. Steel Hinges: Steel pins
  - b. Non-Ferrous Hinges: Stainless steel pins
  - c. Out-Swinging Exterior Doors: Non-removable pins
  - d. Out-Swinging Interior Lockable Doors: Non-removable pins
  - e. Interior Non-lockable Doors: Non-rising pins
- 8. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
- 9. Doors 36 inches (914 mm) wide or less furnish hinges 4-1/2 inches (114 mm) high; doors greater than 36 inches (914 mm) wide furnish hinges 5 inches (127 mm) high, heavy weight or standard weight as specified.

10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component.
11. Provide mortar guard for each electrified hinge specified.
12. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches (2286 mm) or less in height. Provide one additional bearing hinge for each 30 inches (762 mm) of additional door height.

## 2.4 PIVOT SETS

### A. Manufacturers:

1. Scheduled Manufacturer: Ives

### B. Requirements:

1. Provide pivot sets complete with oil-impregnated top pivot, unless indicated otherwise.
2. Where offset pivots are specified, Provide one intermediate pivot for doors less than 91 inches (2311 mm) high and one additional intermediate pivot per leaf for each additional 30 inches (762 mm) in height or fraction thereof. Intermediate pivots spaced equally not less than 25 inches (635 mm) or not more than 35 inches (889 mm) on center, for doors over 121 inches (3073 mm) high.
3. Provide appropriate model where pivot sets are scheduled at fire rated openings.
4. Provide lead-lined model where pivot sets are specified at lead-lined doors.
5. Provide pivots with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electrified pivot nearest to electrified locking component. If manufacturer of electrified locking component requires another device for power transfer then provide recommended power transfer device and appropriate quantity of pivots.
6. Provide mortar guard for each electric pivot specified, unless specified in hollow metal frame specification.

## 2.5 FLUSH BOLTS

### A. Manufacturers:

1. Scheduled Manufacturer: Ives

### B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

## 2.6 COORDINATORS

### A. Manufacturers:

1. Scheduled Manufacturer: Ives

### B. Requirements:

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers and surface vertical rod exit device strikes. Factory-prep coordinators for vertical rod devices if required.

## 2.7 CYLINDRICAL LOCKS – GRADE 1

### A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Best 9K Series
2. Acceptable Manufacturers and Products: No Substitute.

### B. Requirements:

1. Provide cylindrical locks conforming to the following standards and requirements:
  - a. ANSI/BHMA A156.2 Series 4000, Grade 1.
  - b. UL 10C for 4'-0" x 10'-0" 3-hour fire door.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.
4. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
5. Provide electrified options as scheduled in the hardware sets.
6. Lever Design: As scheduled.

## 2.8 EXIT DEVICES

### A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin 99/33 series
2. Acceptable Manufacturers and Products: No Substitute.

### B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Cylinders: Refer to "KEYING" article, herein.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Touchpad: Extend minimum of one half of door width. Match exit device finish, stainless steel for US26, US26D, US28, US32, and US32D finishes; and for all other finishes, provide compatible finish to exit device. No plastic inserts are allowed in touchpads.
4. Provide exit devices with dead-latching feature for security and for future addition of alarm kits and/or other electrified requirements.
5. Provide flush end caps for exit devices.
6. Provide exit devices with manufacturer's approved strikes.
7. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
8. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
9. Provide cylinder dogging at non-fire-rated exit devices.

10. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
11. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
  - a. Lever Style: Match lever style of locksets.
12. Accessibility: Maximum 5lbs force to retract latch bolt per CBC Chapter 11B.

“AX” feature: 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.
13. Provide UL labeled fire exit hardware for fire rated openings.
14. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
15. Provide electrified options as scheduled.

## 2.9 CYLINDERS

### A. Manufacturers:

1. Scheduled Manufacturer: Best
2. Acceptable Manufacturers: No Substitute.

### B. Requirements:

1. Provide permanent interchangeable small format interchangeable core (SFIC) cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to “KEYING” article, herein.
2. Replaceable Construction Cores.
  - a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
    - 1) 3 construction control keys
    - 2) 12 construction change (day) keys.
  - b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

## 2.10 KEYING

- A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- B. Provide cylinders/cores keyed into Owner's existing keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- C. Requirements:
  1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.

- a. Master Keying system as directed by the Owner.
2. Forward biting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
3. Provide keys with the following features:
  - a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
  - b. Patent Protection: Keys and blanks protected by one or more utility patent(s)
4. Identification:
  - a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.
  - b. Identification stamping provisions must be approved by the Architect and Owner.
  - c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE"
  - d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
  - e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
5. Quantity: Furnish in the following quantities.
  - a. Change (Day) Keys: 3 per cylinder/core.
  - b. Permanent Control Keys: 3.
  - c. Master Keys: 6.

## 2.11 DOOR CLOSERS

### A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4010/4110/4020 series.
2. Acceptable Manufacturers and Products: No Substitute.

### B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Certify surface mounted mechanical closers to meet fifteen million (15,000,000) full load cycles. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter with 11/16 inch (17 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and 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 backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers. When closers are parallel arm mounted, provide closers which mount within 6-inch (152 mm) top rail without use of mounting plate so that closer is not visible through vision panel from pull side.

8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide 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.

## 2.12 DOOR TRIM

### A. Manufacturers:

1. Scheduled Manufacturer: Ives

### B. Requirements:

1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
7. Provide wire pulls of solid bar stock, diameter and length as scheduled.
8. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

## 2.13 PROTECTION PLATES

### A. Manufacturers:

1. Scheduled Manufacturer: Ives

### B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
  - a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
  - b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
  - c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

## 2.14 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

### A. Manufacturers:

1. Scheduled Manufacturers: Glynn-Johnson

B. Requirements:

1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

## 2.15 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

## 2.16 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:
  - a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
  - b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

## 2.17 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives



B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

## 2.18 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
3. Protection Plates: BHMA 630 (US32D)
4. Overhead Stops and Holders: Powder Coat to Match
5. Door Closers: Powder Coat to Match
6. Wall Stops: BHMA 630 (US32D)
7. Weatherstripping: Clear Anodized Aluminum
8. Thresholds: Mill Finish Aluminum

## 2.19 SPECIAL FINISHES

A. Antimicrobial coatings

1. Furnish with antimicrobial coated hardware items designed with AM suffix to the finish, 626AM and /or 630AM. The non-toxic coating to be natural inorganic silver-ion based antimicrobial added to the clear coating. The powder coat containing the antimicrobial compound to be electro-statically applied to a minimum thickness of 1.5 mils. The antimicrobial coatings are to protect the surface of the hardware item by inhibiting the growth of bacteria, mold, mildew, and odor. The antimicrobial coating shall pass the BHMA clear coat requirements and be registered with the EPA and FDA listed.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Existing frames and doors to be retrofitted with new hardware:
  1. Field-verify conditions and dimensions prior to ordering hardware. Fill existing hardware cut outs not being reused by the new hardware. Remove existing hardware not being reused, return to Owner unless directed otherwise.
  2. Remove existing floor closers not scheduled for reuse, fill cavities with non-shrinking concrete and finish smooth.

3. Cut and weld existing steel frames currently prepared with 2.25 inch height strikes. Cut an approximate 8 inch section from the strike jamb and weld in a reinforced section to accommodate specified hardware's strike.
4. Patch and weld flush filler pieces into existing door hardware preparations in steel doors and frames, leave surfaces smooth.

### 3.2 PREPARATION

- A. Where on-site modification of doors and frames is required:
  1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
  2. Field modify and prepare existing door and frame for new hardware being installed.
  3. When modifications are exposed to view, use concealed fasteners, when possible.
  4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
    - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
    - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
    - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

### 3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
  1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
  2. Custom Steel Doors and Frames: HMMA 831.
  3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- H. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).

- I. Lock Cylinders: Install construction cores to secure building and areas during construction period.
  - 1. Replace construction cores with permanent cores as indicated in keying section.
- J. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- K. 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.
- L. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- M. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
  - 1. Coordination: Coordinate provision with the security systems provider to mitigate excessive or redundant purchase.
  - 2. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.
- N. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- O. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- P. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- Q. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- R. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
- S. Field-verify existing conditions and measurements prior to ordering hardware. Fill existing hardware cut outs not being used by the new hardware.
- T. Remove existing hardware not being reused. Tag and bag removed hardware, turn over to Owner.
- U. Where existing wall conditions will not allow door to swing using the scheduled hinges, provide wide-throw hinges and if needed, extended arms on closers.
- V. Provide manufacturer's recommended brackets to accommodate the mounting of closers on doors with flush transoms.

### 3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
  - 1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
  - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
  - 3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

- B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

### 3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

### 3.6 DEMONSTRATION

- A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

### 3.7 DOOR HARDWARE SCHEDULE

- A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.
- B. Do not order material until submittal has been reviewed, stamped, and signed by Architect's door hardware consultant.
- C. Hardware Sets:

49093 OPT0197188 Version 1  
HW SET: 1

Door(s):

801A

2	EA	PIVOT SET	7215 SET	626	IVE
4	EA	INTERMEDIATE PIVOT	7215 INT	626	IVE
1	EA	REMOVABLE MULLION	KR4954 STAB	689	VON
1	EA	PANIC HARDWARE	PA-AX-35A-EO	626	VON
1	EA	PANIC HARDWARE	PA-AX-35A-L-NL-360-06	626	VON
2	EA	MORTISE CYLINDER	1E74 C4	626	BES
2	EA	SFIC CYL. CORE	PERMANENT CORE	626	BES
2	EA	CONSTRUCTION CORE	1C7-GREEN	626	BES
2	EA	SURFACE CLOSER	4111 EDA	689	LCN
2	EA	MOUNTING PLATE	4110-18	689	LCN
2	EA	FLOOR STOP	FS441/FS444 AS REQ'D	626	IVE
1	SET	SEALS	BY DOOR/FRAME MANUFACTURER		B/O
1	EA	THRESHOLD	AS DETAILED		

HW SET: 2

Door(s):

805

3	EA	HINGE	3CB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM SECURITY LOCK	9K3-7-IN-15-D-S3	626	BES
2	EA	SFIC CYL. CORE	PERMANENT CORE	626	BES
2	EA	CONSTRUCTION CORE	1C7-GREEN	626	BES
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS438/FS436	626	IVE
3	EA	SILENCER	SR64/SR65	GRY	IVE

VERIFY EXISTING CONDITIONS PRIOR TO ORDERING HARDWARE.

HW SET: 3

Door(s):

808

903

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY LOCK	9K3-7-IN-15-D-S3	626	BES
2	EA	SFIC CYL. CORE	PERMANENT CORE	626	BES
2	EA	CONSTRUCTION CORE	1C7-GREEN	626	BES
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS438/FS436	626	IVE
3	EA	SILENCER	SR64/SR65	GRY	IVE

HW SET: 4

Door(s):

807

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	9K3-7-R-15-D-S3	626	BES
1	EA	SFIC CYL. CORE	PERMANENT CORE	626	BES
1	EA	CONSTRUCTION CORE	1C7-GREEN	626	BES
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS438/FS436	626	IVE
3	EA	SILENCER	SR64/SR65	GRY	IVE

HW SET: 5

Door(s):

807A

807C

3	EA	HINGE	3CB1HW SH 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	PA-AX-98-L-NL-06	626	VON
1	EA	RIM CYLINDER	12E72-S2-RP	626	BES
1	EA	SFIC CYL. CORE	PERMANENT CORE	626	BES
1	EA	CONSTRUCTION CORE	1C7-GREEN	626	BES
1	EA	SURFACE CLOSER	4111 EDA ST-1631	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS441/FS444 AS REQ'D	626	IVE
1	EA	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	AS DETAILED		

HW SET: 6

Door(s):

809

3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	9K3-0-L-15-D-S3	626	BES
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS438/FS436	626	IVE
3	EA	SILENCER	SR64/SR65	GRY	IVE

HW SET: 7

Door(s):

810

6	EA	HINGE	3CB1 4.5 X 4.5 NRP	652	IVE
1	SET	AUTO FLUSH BOLT	FB31P	630	IVE
1	EA	DUST PROOF STRIKE	DP	626	IVE
1	EA	CLASSROOM LOCK	9K3-7-R-15-D-S3	626	BES
1	EA	SFIC CYL. CORE	PERMANENT CORE	626	BES
1	EA	CONSTRUCTION CORE	1C7-GREEN	626	BES
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	OH STOP & HOLDER	410F	689	GLY
2	EA	SILENCER	SR64/SR65	GRY	IVE

HW SET: 8

Door(s):

923

4	EA	HINGE	3CB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	DUTCH DOOR BOLT	054	626	IVE
1	EA	CLASSROOM SECURITY LOCK	9K3-7-IN-15-D-S3	626	BES
2	EA	SFIC CYL. CORE	PERMANENT CORE	626	BES
2	EA	CONSTRUCTION CORE	1C7-GREEN	626	BES
1	EA	OH STOP & HOLDER	100HP	689	GLY
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS438/FS436	626	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
4	EA	SILENCER	SR64/SR65	GRY	IVE

END OF SECTION

## **SECTION 08 80 00 - GLAZING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Insulating glass units.
- B. Glazing units.
- C. Glazing compounds and accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 25 00 - Weather Barriers.
- B. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.
- C. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- D. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.
- E. Section 08 36 13 - Sectional Doors: Glazed lites in doors.
- F. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2015).
- B. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- C. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.
- D. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.
- E. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.
- F. GANA (SM) - GANA Sealant Manual; 2008.
- G. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2017.
- H. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014, with Errata (2017).
- I. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2017.

#### **1.04 SUBMITTALS**

- A. Product Data on Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- B. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### **1.05 FIELD CONDITIONS**

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

#### **1.06 WARRANTY**

- A. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.



## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Glass Fabricators:
  - 1. GGI - General Glass International: [www.generalglass.com/#sle](http://www.generalglass.com/#sle).
  - 2. Trulite Glass & Aluminum Solutions, LLC: [www.trulite.com/#sle](http://www.trulite.com/#sle).
  - 3. Viracon, Inc: [www.viracon.com/#sle](http://www.viracon.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES**

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
  - 1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
  - 2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
  - 3. Glass thicknesses listed are minimum.
- B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
  - 1. In conjunction with vapor retarder and joint sealer materials described in other sections.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
  - 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
  - 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
  - 3. Solar Optical Properties: Comply with NFRC 300 test method.

### **2.03 GLASS MATERIALS**

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.

### **2.04 INSULATING GLASS UNITS**

- A. Manufacturers:
  - 1. Guardian Glass, LLC: [www.guardianglass.com/#sle](http://www.guardianglass.com/#sle).
  - 2. Pilkington North America Inc: [www.pilkington.com/na/#sle](http://www.pilkington.com/na/#sle).
  - 3. Viracon, Apogee Enterprises, Inc: [www.viracon.com/#sle](http://www.viracon.com/#sle).
  - 4. Vitro Architectural Glass (formerly PPG Glass): [www.vitroglazings.com/#sle](http://www.vitroglazings.com/#sle).
  - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulating Glass Units: Types as indicated.
  - 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
  - 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
  - 3. Spacer Color: Black.
  - 4. Edge Seal:
    - a. Color: Black.
  - 5. Purge interpane space with dry air, hermetically sealed.

### **2.05 ACCESSORIES**

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

- B. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
- C. Glazing Clips: Manufacturer's standard type.

## **PART 3 EXECUTION**

### **3.01 VERIFICATION OF CONDITIONS**

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- C. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

### **3.03 INSTALLATION, GENERAL**

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

### **3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)**

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

### **3.05 CLEANING**

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove non-permanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

### **3.06 PROTECTION**

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

**END OF SECTION**

## **SECTION 08 83 00 - MIRRORS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Glass mirrors.
  - 1. Annealed float glass.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 10 28 00 - Toilet, Bath, and Laundry Accessories: Metal mirror frames.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C1036 - Standard Specification for Flat Glass; 2016.

#### **1.04 SUBMITTALS**

- A. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- B. Product Data on Glazing Compounds: Submit chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

#### **1.05 QUALITY ASSURANCE**

- A. Fabricate, store, transport, receive, install, and clean mirrors in accordance with manufacturer's recommendations.

#### **1.06 FIELD CONDITIONS**

- A. Do not install mirrors when ambient temperature is less than 50 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Mirrors:
  - 1. Binswanger Mirror/ACI Distribution: [www.binswangerglass.com/#sle](http://www.binswangerglass.com/#sle).
  - 2. Lenoir Mirror Co: [www.lenoirmirror.com/#sle](http://www.lenoirmirror.com/#sle).
  - 3. Trulite Glass and Aluminum Solutions: [www.trulite.com/#sle](http://www.trulite.com/#sle).
  - 4. Walker Glass Company Ltd: [www.walkerglass.com/#sle](http://www.walkerglass.com/#sle).
  - 5. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.02 MATERIALS**

- A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.
- B. Mirror Glass: Clear, annealed float glass; ASTM C1036, with copper and silver coatings, and protective overcoating.
  - 1. Thickness: 1/4 inch.
  - 2. Size: As indicated on drawings.

#### **2.03 ACCESSORIES**

- A. Glazing Clips: Manufacturer's standard type.
- B. Mirror Attachment Accessories: Stainless steel clips.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that openings for mirrored glazing are correctly sized and within tolerance.
- B. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

### **3.02 PREPARATION**

- A. Clean contact surfaces with solvent and wipe dry.

### **3.03 INSTALLATION**

- A. Install mirrors in accordance with manufacturer's recommendations.
- B. Set mirrors plumb and level, and free of optical distortion.
- C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

### **3.04 CLEANING**

- A. Remove labels after work is complete.
- B. Clean mirrors and adjacent surfaces.

**END OF SECTION**

## **SECTION 09 05 61 - COMMON WORK RESULTS FOR FLOORING PREPARATION**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
  - 1. Resilient tile and sheet.
  - 2. Carpet tile.
  - 3. Thin-set ceramic tile and stone tile.
- B. Removal of existing floor coverings.
- C. Preparation of existing concrete floor slabs for installation of floor coverings.
- D. Testing of concrete floor slabs for moisture and alkalinity (pH).
- E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
  - 1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.
- B. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- C. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2011.

#### **1.04 SUBMITTALS**

- A. Visual Observation Report: For existing floor coverings to be removed.
- B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
  - 1. Moisture and alkalinity (pH) limits and test methods.
  - 2. Manufacturer's required bond/compatibility test procedure.
- C. Testing Agency's Report:
  - 1. Description of areas tested; include floor plans and photographs if helpful.
  - 2. Summary of conditions encountered.
  - 3. Moisture and alkalinity (pH) test reports.
  - 4. Copies of specified test methods.
  - 5. Recommendations for remediation of unsatisfactory surfaces.
  - 6. Submit report to Architect.
  - 7. Submit report not more than two business days after conclusion of testing.
- D. Adhesive Bond and Compatibility Test Report.
- E. Copy of RFCI (RWP).

#### **1.05 QUALITY ASSURANCE**

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.

1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- C. Contractor's Responsibility Relating to Independent Agency Testing:
  1. Provide access for and cooperate with testing agency.
  2. Confirm date of start of testing at least 10 days prior to actual start.
  3. Allow at least 4 business days on site for testing agency activities.
  4. Achieve and maintain specified ambient conditions.
  5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

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

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

#### **1.07 FIELD CONDITIONS**

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

### **PART 2 PRODUCTS**

### **PART 3 EXECUTION**

#### **3.01 CONCRETE SLAB PREPARATION**

- A. Perform following operations in the order indicated:
  1. Preliminary cleaning.
  2. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
  3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
  4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
  5. Specified remediation, if required.
  6. Patching, smoothing, and leveling, as required.
  7. Other preparation specified.
  8. Adhesive bond and compatibility test.
  9. Protection.

#### **3.02 REMOVAL OF EXISTING FLOOR COVERINGS**

- A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.
- B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

#### **3.03 PRELIMINARY CLEANING**

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

### **3.04 MOISTURE VAPOR EMISSION TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
- F. Report: Report the information required by the test method.

### **3.05 INTERNAL RELATIVE HUMIDITY TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.
- D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- F. Report: Report the information required by the test method.

### **3.06 ALKALINITY TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

### **3.07 PREPARATION**

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with requirements and recommendations of floor covering manufacturer.
- C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- D. Do not fill expansion joints, isolation joints, or other moving joints.

### **3.08 ADHESIVE BOND AND COMPATIBILITY TESTING**

- A. Comply with requirements and recommendations of floor covering manufacturer.

### **3.09 PROTECTION**

- A. Cover prepared floors with building paper or other durable covering.

**END OF SECTION**

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

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Gypsum sheathing.
- B. Gypsum wallboard.
- C. Joint treatment and accessories.
- D. Water-resistive barrier over exterior wall sheathing.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Building framing and sheathing.
- B. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 07 21 00 - Thermal Insulation: Acoustic insulation.
- D. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.
- E. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017.
- B. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2019b.
- C. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018.
- D. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- E. GA-216 - Application and Finishing of Gypsum Panel Products; 2016.

#### **1.04 SUBMITTALS**

- A. Shop Drawings: Indicate special details associated with acoustic seals.
- B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

### **PART 2 PRODUCTS**

#### **2.01 GYPSUM BOARD ASSEMBLIES**

- A. Provide completed assemblies complying with ASTM C840 and GA-216.

#### **2.02 BOARD MATERIALS**

- A. Manufacturers - Gypsum-Based Board:
  - 1. American Gypsum Company: [www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
  - 2. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 3. Georgia-Pacific Gypsum: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
  - 4. National Gypsum Company: [www.nationalgypsum.com/#sle](http://www.nationalgypsum.com/#sle).
  - 5. PABCO Gypsum: [www.pabco gypsum.com/#sle](http://www.pabco gypsum.com/#sle).
  - 6. USG Corporation: [www.usg.com/#sle](http://www.usg.com/#sle).
  - 7. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
  - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
- C. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
  - 1. Application: Exterior sheathing, unless otherwise indicated.
  - 2. Edges: Square.



## **2.03 GYPSUM WALLBOARD ACCESSORIES**

- A. Acoustic Insulation: As specified in Section 07 21 00.
- B. Water-Resistive Barrier: As specified in Section 07 25 00.
- C. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that project conditions are appropriate for work of this section to commence.

### **3.02 BOARD INSTALLATION**

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- C. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
  - 1. Seal joints, cut edges, and holes with water-resistant sealant.
  - 2. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.
- D. Installation on Wood Framing: For nonrated assemblies, install as follows:
  - 1. Single-Layer Applications: Screw attachment.

### **3.03 INSTALLATION OF TRIM AND ACCESSORIES**

- A. Control Joints: Place control joints consistent with lines of building spaces and as directed.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

### **3.04 JOINT TREATMENT**

- A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
  - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
  - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
  - 3. Level 3: Walls to receive textured wall finish.
  - 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
- B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
  - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
- C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

**END OF SECTION**

## **SECTION 09 22 36 - LATH**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Metal lath for cement and gypsum plaster.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Sheathing on exterior walls.
- B. Section 06 10 00 - Rough Carpentry: Water-resistive barrier under exterior plaster and stucco.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C841 - Standard Specification for Installation of Interior Lathing and Furring; 2003 (Reapproved 2018).
- B. ASTM C847 - Standard Specification for Metal Lath; 2018.

#### **1.04 SUBMITTALS**

- A. Product Data: Provide data on furring and lathing components, structural characteristics, material limitations, and finish.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Metal Lath and Accessories:
  - 1. CEMCO: [www.cemcosteel.com/#sle](http://www.cemcosteel.com/#sle).
  - 2. Clarkwestern Dietrich Building Systems LLC: [www.clarkdietrich.com/#sle](http://www.clarkdietrich.com/#sle).
  - 3. Phillips Manufacturing Co: [www.phillipsmfg.com/#sle](http://www.phillipsmfg.com/#sle).
  - 4. Semco Southeastern Metals: [www.semetals.com/#sle](http://www.semetals.com/#sle).
  - 5. Structa Wire Corporation; Structa Mega Lath: [www.structawire.com/#sle](http://www.structawire.com/#sle).
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.02 LATH**

- A. Diamond Mesh Metal Lath: ASTM C847, galvanized; self-furring.
- B. Beads, Screeds, Joint Accessories, and Other Trim: Depth governed by plaster thickness, and maximum possible lengths.

#### **2.03 ACCESSORIES**

- A. Anchorage: Tie wire, nails, and other metal supports, of type and size to suit application; to rigidly secure materials in place, galvanized.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that substrates are ready to receive work and conditions are suitable for application.
- C. For exterior plaster and stucco on stud walls, verify that water-resistive barrier has been installed over sheathing substrate completely and correctly.
- D. Do not begin until unacceptable conditions have been corrected.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

#### **3.02 INSTALLATION - GENERAL**

- A. Install metal lath and furring for Portland cement plaster in accordance with ASTM C1063.

#### **3.03 LATH INSTALLATION**

- A. Apply lath taut, with long dimension perpendicular to supports.
- B. Lap or nest ends of metal lath in accordance with ASTM C841.

- C. Continuously reinforce internal angles with corner mesh, except where the metal lath returns 3 inches from corner to form the angle reinforcement; fasten at perimeter edges only.
- D. Place corner bead at external wall corners; fasten at outer edges of lath only.
- E. Place base screeds at termination of plaster areas; secure rigidly in place.
- F. Place lath vertically above each top corner and each side of door frames to 6 inches above ceiling line.
- G. Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.
- H. Place additional strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

**END OF SECTION**

## **SECTION 09 24 00 - CEMENT PLASTERING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Cement plastering.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Wood stud framing for plaster.
- B. Section 07 25 00 - Weather Barriers.
- C. Section 09 22 36 - Lath: Lath, furring, beads, screeds, and joint accessories for plaster base.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster; 2020.

#### **1.04 SUBMITTALS**

- A. Product Data: Provide data on plaster materials and trim accessories.

#### **1.05 FIELD CONDITIONS**

- A. Exterior Plaster Work: Do not apply plaster when substrate or ambient air temperature is 40 degrees F or lower, or when temperature is expected to drop below 40 degrees F within 48 hours of application.

### **PART 2 PRODUCTS**

#### **2.01 CEMENT PLASTER APPLICATIONS**

- A. Lath Plaster Base: Metal lath.
  - 1. Plaster Type: Factory prepared plaster mix.
  - 2. Number of Coats: Three.
  - 3. First Coat: Apply to a nominal thickness of 3/8 inch.
  - 4. Second Coat: Apply to a nominal thickness of 3/8 inch.
  - 5. Finish Coat: Apply to a nominal thickness of 1/8 inch.

#### **2.02 FACTORY PREPARED CEMENT PLASTER**

- A. Exterior Portland cement plaster system made of scratch and brown base coat, leveling coat with reinforcing mesh, and acrylic finish coat; install in accordance with ASTM C926.
  - 1. Provide weather resistive barrier as part of the system.
  - 2. Manufacturer - Basis of Design:
    - a. LaHabra: [www.lahabrastucco.com/#sle](http://www.lahabrastucco.com/#sle).
  - 3. Other Acceptable Manufacturers:
    - a. BASF Wall Systems: [www.wallsystems.basf.com/#sle](http://www.wallsystems.basf.com/#sle).
    - b. Parex USA, Inc: [www.parexusa.com/#sle](http://www.parexusa.com/#sle).
    - c. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.03 ACCESSORIES**

- A. Lath: As specified in Section 09 22 36.
- B. Beads, Screeds, and Joint Accessories: As specified in Section 09 22 36.
- C. Reinforcing Mesh: 4.5 oz/sq yd alkali-resistant mesh.
- D. Water Resistive Barrier: As specified in Section 07 25 00.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are properly in place.

## **SECTION 09 30 00 - TILING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Cementitious backer board as tile substrate.
- D. Ceramic accessories.
- E. Ceramic trim.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.

#### **1.03 REFERENCE STANDARDS**

- A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2017.
- B. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 2017.
- C. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2016).
- D. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship; 2019.
- E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).
- F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).
- H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).
- I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).
- J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017.
- K. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).
- L. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2016).
- M. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2017.
- N. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2019.

#### **1.04 SUBMITTALS**

- A. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

- B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

#### **1.06 FIELD CONDITIONS**

- A. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

### **PART 2 PRODUCTS**

#### **2.01 TILE**

- A. Manufacturers: All products by the same manufacturer.
  - 1. American Olean Corporation: [www.americanolean.com/#sle](http://www.americanolean.com/#sle).
  - 2. Dal-Tile Corporation: [www.daltile.com/#sle](http://www.daltile.com/#sle).
  - 3. Emser Tile, LLC: [www.emser.com/#sle](http://www.emser.com/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.02 TRIM AND ACCESSORIES**

- A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.
- B. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
  - 1. Manufacturers: Same as for tile.

#### **2.03 SETTING MATERIALS**

- A. Provide setting and grout materials from same manufacturer.

#### **2.04 GROUTS**

- A. Provide setting and grout materials from same manufacturer.

#### **2.05 PERFORMANCE**

- A. Tile flooring shall be slip resistant with a coefficient of friction at or above 0.60.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Verify that required floor-mounted utilities are in correct location.

#### **3.02 PREPARATION**

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

### **3.03 INSTALLATION - GENERAL**

- A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19 , manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install ceramic accessories rigidly in prepared openings.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Keep control and expansion joints free of mortar, grout, and adhesive.
- I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- J. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

### **3.04 INSTALLATION - FLOORS - THIN-SET METHODS**

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.

### **3.05 INSTALLATION - WALL TILE**

- A. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.

### **3.06 CLEANING**

- A. Clean tile and grout surfaces.

### **3.07 PROTECTION**

- A. Do not permit traffic over finished floor surface for 4 days after installation.

**END OF SECTION**

- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install ceramic accessories rigidly in prepared openings.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Keep control and expansion joints free of mortar, grout, and adhesive.
- I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- J. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

#### **3.04 INSTALLATION - FLOORS - THIN-SET METHODS**

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.

#### **3.05 INSTALLATION - WALL TILE**

- A. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.

#### **3.06 CLEANING**

- A. Clean tile and grout surfaces.

#### **3.07 PROTECTION**

- A. Do not permit traffic over finished floor surface for 4 days after installation.

**END OF SECTION**



## **SECTION 09 51 00 - ACOUSTICAL CEILINGS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 07 21 00 - Thermal Insulation: Acoustical insulation.

#### **1.03 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. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2017.
- C. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2019.

#### **1.04 SUBMITTALS**

- A. Shop Drawings: Indicate grid layout and related dimensioning.
- B. Product Data: Provide data on suspension system components and acoustical units.
- C. Evaluation Service Reports: Show compliance with specified requirements.
- D. Samples: Submit two samples 4 by 4 inch in size illustrating material and finish of acoustical units.
- E. Samples: Submit two samples each, 6 inches long, of suspension system main runner, cross runner, and perimeter molding.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

#### **1.05 FIELD CONDITIONS**

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Acoustic Tiles/Panels:
  - 1. Armstrong World Industries, Inc: [www.armstrongceilings.com/#sle](http://www.armstrongceilings.com/#sle).
  - 2. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 3. USG Corporation: [www.usg.com/ceilings/#sle](http://www.usg.com/ceilings/#sle).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Suspension Systems:
  - 1. Same as for acoustical units.

#### **2.02 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category D, E, or F and complying with the following:
  - 1. Local authorities having jurisdiction.

#### **2.03 ACOUSTICAL UNITS**

- A. Acoustical Tiles: Mineral fiber with membrane-faced overlay, with the following characteristics:
  - 1. Classification: ASTM E1264 Type IV.
  - 2. Size: 24 by 48 inch.
  - 3. Thickness: 3/4 inch.
  - 4. Tile Edge: Square.

5. Suspension System: Semi-concealed grid.
6. Products:
  - a. USG Corporation; Mars Acoustical Panels: [www.usg.com/ceilings/#sle](http://www.usg.com/ceilings/#sle).
  - b. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.04 SUSPENSION SYSTEM(S)**

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

#### **3.02 PREPARATION**

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

#### **3.03 INSTALLATION - SUSPENSION SYSTEM**

- A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- B. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- C. Seismic Suspension System, Seismic Design Categories D, E, F: Hang suspension system with grid ends attached to the perimeter molding on two adjacent walls; on opposite walls, maintain a 3/4 inch clearance between grid ends and wall.
- D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- E. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- F. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- G. Do not eccentrically load system or induce rotation of runners.

#### **3.04 INSTALLATION - ACOUSTICAL UNITS**

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
  1. Make field cut edges of same profile as factory edges.

**END OF SECTION**

## **SECTION 09 65 00 - RESILIENT FLOORING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Resilient tile flooring.
- B. Resilient base.
- C. Installation accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.
- B. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- C. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2018).
- B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2016.

#### **1.04 SUBMITTALS**

- A. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- B. Shop Drawings: Indicate seaming plans and floor patterns.
- C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- D. Verification Samples: Submit two samples, 4 by 12 inch in size illustrating color and pattern for each resilient flooring product specified.
- E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Do not double stack pallets.

#### **1.06 FIELD CONDITIONS**

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

### **PART 2 PRODUCTS**

#### **2.01 SHEET FLOORING**

#### **2.02 TILE FLOORING**

- A. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness.
  - 1. Manufacturers:
    - a. Armstrong Flooring, Inc: [www.armstrongflooring.com/#sle](http://www.armstrongflooring.com/#sle).
    - b. Johnsonite, a Tarkett Company: [www.johnsonite.com/#sle](http://www.johnsonite.com/#sle).
    - c. Substitutions: See Section 01 60 00 - Product Requirements.

2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
3. Color: As indicated on drawings.

## **2.03 RESILIENT BASE**

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; style as scheduled.
  1. Manufacturers:
    - a. Burke Flooring: [www.burkeflooring.com/#sle](http://www.burkeflooring.com/#sle).
    - b. Johnsonite, a Tarkett Company: [www.johnsonite.com/#sle](http://www.johnsonite.com/#sle).
    - c. Roppe Corp: [www.roppe.com/#sle](http://www.roppe.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  2. Color: As indicated on drawings.

## **2.04 ACCESSORIES**

- A. Adhesive for Vinyl Flooring:
  1. Manufacturers:
    - a. Stauf USA, LLC: [www.staufusa.com/#sle](http://www.staufusa.com/#sle).
    - b. TEC, an H.B. Fuller Construction Products Brand: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
    - c. Substitutions: Section 01 60 00 - Product Requirements.
- B. Moldings, Transition and Edge Strips: Same material as flooring.
- C. Sealer and Wax: Types recommended by flooring manufacturer.

## **2.05 PERFORMANCE**

- A. Vinyl flooring shall be slip resistant with a coefficient of friction at or above 0.60.

# **PART 3 EXECUTION**

## **3.01 EXAMINATION**

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
  1. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

## **3.02 PREPARATION**

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

## **3.03 INSTALLATION - GENERAL**

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
  1. Spread only enough adhesive to permit installation of materials before initial set.
  2. Fit joints and butt seams tightly.
  3. Set flooring in place, press with heavy roller to attain full adhesion.
- D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

#### **3.04 INSTALLATION - TILE FLOORING**

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

#### **3.05 INSTALLATION - RESILIENT BASE**

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Install base on solid backing. Bond tightly to wall and floor surfaces.

#### **3.06 CLEANING**

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

#### **3.07 PROTECTION**

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

**END OF SECTION**

## **SECTION 09 68 13 - TILE CARPETING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Carpet tile, fully adhered.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.
- B. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- C. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

#### **1.03 REFERENCE STANDARDS**

#### **1.04 SUBMITTALS**

- A. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- B. Shop Drawings: Indicate layout of joints.
- C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

#### **1.05 FIELD CONDITIONS**

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Tile Carpeting:
  - 1. Interface, Inc: [www.interface.com/#sle](http://www.interface.com/#sle).
  - 2. Milliken & Company: [www.milliken.com/#sle](http://www.milliken.com/#sle).
  - 3. Mohawk Group: [www.mohawkgroup.com/#sle](http://www.mohawkgroup.com/#sle).
  - 4. Mannington: [www.mannington.com](http://www.mannington.com).
  - 5. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.02 MATERIALS**

- A. Tile Carpeting: Tufted, manufactured in one color dye lot.
  - 1. Tile Size: 24 by 24 inch, nominal.
  - 2. Color: See Drawings.
  - 3. Pattern: See Drawings.
  - 4. Pile: 1/2" maximum pile height and level, or cut pile

#### **2.03 ACCESSORIES**

- A. Edge Strips: Embossed aluminum, color per plans.
- B. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
  - 1. Test in accordance with Section 09 05 61.

2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

- D. Verify that required floor-mounted utilities are in correct location.

### **3.02 PREPARATION**

- A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

### **3.03 INSTALLATION**

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Locate change of color or pattern between rooms under door centerline.
- G. Fully adhere carpet tile to substrate.
- H. Trim carpet tile neatly at walls and around interruptions.
- I. Complete installation of edge strips, concealing exposed edges.

### **3.04 CLEANING**

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

**END OF SECTION**

## **SECTION 09 91 13 - EXTERIOR PAINTING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
  - 5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
  - 6. Marble, granite, slate, and other natural stones.
  - 7. Floors, unless specifically indicated.
  - 8. Ceramic and other types of tiles.
  - 9. Glass.
  - 10. Concealed pipes, ducts, and conduits.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- B. Section 09 91 23 - Interior Painting.

#### **1.03 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- C. SCAQMD 1113 - Architectural Coatings; 1977 (Amended 2016).

#### **1.04 SUBMITTALS**

- A. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  - 2. MPI product number (e.g. MPI #47).
  - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.



## **1.06 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
  - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
- B. Paints:
  - 1. PPG Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
  - 2. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
  - 3. Dunn-Edwards; [www.dunn-edwards.com](http://www.dunn-edwards.com).
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.02 PAINTS AND FINISHES - GENERAL**

- A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
  - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  - 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
  - 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
  - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
    - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
    - b. SCAQMD 1113 Rule.
  - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Colors: As indicated on drawings.

### **2.03 PAINT SYSTEMS - EXTERIOR**

- A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete masonry units and primed metal.
  - 1. Two top coats and one coat primer.
- B. Paint GE-OP-3A - Exterior Gypsum Board and Exterior Plaster, Opaque, Alkyd, 3 Coat:
  - 1. One coat of alkyd primer sealer.
  - 2. Flat: Two coats of alkyd enamel; \_\_\_\_\_.
- C. Paint ME-OP-2A - Ferrous Metals, Primed, Alkyd, 2 Coat:
  - 1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.

- D. Paint MgE-OP-3A - Galvanized Metals, Alkyd, 3 Coat:
  - 1. One coat galvanize primer.

## **2.04 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
  - 1. Exterior Plaster and Stucco: 12 percent.
  - 2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Masonry:
  - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
  - 2. Prepare surface as recommended by top coat manufacturer.
- G. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

### **3.03 APPLICATION**

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance.
- D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### **3.04 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

### **3.05 PROTECTION**

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

### **3.06 COLOR SCHEDULE**

**END OF SECTION**

## **SECTION 09 91 23 - INTERIOR PAINTING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
  - 5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
  - 6. Marble, granite, slate, and other natural stones.
  - 7. Floors, unless specifically indicated.
  - 8. Ceramic and other tiles.
  - 9. Glass.
  - 10. Acoustical materials, unless specifically indicated.
  - 11. Concealed pipes, ducts, and conduits.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- B. Section 09 91 13 - Exterior Painting.

#### **1.03 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- D. SCAQMD 1113 - Architectural Coatings; 1977 (Amended 2016).
- E. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- F. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

#### **1.04 SUBMITTALS**

- A. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  - 2. MPI product number (e.g. MPI #47).
  - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

#### **1.06 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
  - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
- B. Paints:
  - 1. PPG Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
  - 2. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
  - 3. Dunn-Edwards: [www.dunn-edwards.com](http://www.dunn-edwards.com).
- C. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.02 PAINTS AND FINISHES - GENERAL**

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
  - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  - 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
  - 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
  - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
    - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
    - b. SCAQMD 1113 Rule.
  - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Colors: As indicated on drawings.

#### **2.03 PAINT SYSTEMS - INTERIOR**

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, wood, plaster, and shop primed steel.
  - 1. Two top coats and one coat primer.
- B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
  - 1. Two top coats and one coat primer.

- C. Paint I-OP-MD-WC - Medium Duty Vertical and Overhead: Including gypsum board, plaster, and shop primed steel.
  - 1. Two top coats and one coat primer.
- D. Paint WI-OP-3A - Wood, Opaque, Alkyd, 3 Coat:
  - 1. One coat alkyd primer sealer.
- E. Paint GI-OP-3A - Gypsum Board/Plaster, Alkyd, 3 Coat:
  - 1. One coat of alkyd primer sealer.

## **2.04 PRIMERS**

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
  - 1. Alkali Resistant Water Based Primer; MPI #3.
  - 2. Interior Drywall Primer Sealer.

## **2.05 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

# **PART 3 EXECUTION**

## **3.01 EXAMINATION**

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
  - 1. Gypsum Wallboard: 12 percent.
  - 2. Plaster and Stucco: 12 percent.
  - 3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

## **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- F. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- G. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
  - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

- H. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

### **3.03 APPLICATION**

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Sand wood and metal surfaces lightly between coats to achieve required finish.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### **3.04 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

### **3.05 PROTECTION**

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

**END OF SECTION**

## **SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Commercial toilet accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 08 83 00 - Mirrors: Other mirrors.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C1036 - Standard Specification for Flat Glass; 2016.
- B. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2018.

#### **1.04 SUBMITTALS**

- A. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- B. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Commercial Toilet, Shower, and Bath Accessories:
  - 1. AJW Architectural Products: [www.ajw.com/#sle](http://www.ajw.com/#sle).
  - 2. American Specialties, Inc: [www.americanspecialties.com/#sle](http://www.americanspecialties.com/#sle).
  - 3. Bradley Corporation: [www.bradleycorp.com/#sle](http://www.bradleycorp.com/#sle).
  - 4. Georgia-Pacific Professional: [www.blue-connect.com/#sle](http://www.blue-connect.com/#sle).
  - 5. Substitutions: Section 01 60 00 - Product Requirements.

#### **2.02 MATERIALS**

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
- B. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- C. Adhesive: Two component epoxy type, waterproof.
- D. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

#### **2.03 FINISHES**

- A. Stainless Steel: Satin finish, unless otherwise noted.

#### **2.04 COMMERCIAL TOILET ACCESSORIES**

- A. Combination Toilet Paper Dispenser/Toilet Seat Cover/Napkin Disposal: Double roll, recess mounted flush with wall surface.
  - 1. Products:
    - a. See Drawings.
  - 2. Toilet tissue dispenser to be continuous flow type.
- B. Combination Towel Dispenser/Waste Receptacle: Recessed with projecting waste receptacle, stainless steel; seamless wall flanges, continuous piano hinges.
  - 1. Products:
    - a. See Drawings.
- C. Soap Dispenser: Soap lather dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gauge refill indicator, tumbler lock.
  - 1. Products:
    - a. See Drawings.



- D. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
- E. Grab Bars: Stainless steel, smooth surface.
  - 1. Standard Duty Grab Bars:
    - a. Push/Pull Point Load: 250 pound-force, minimum.
    - b. Dimensions: 1-1/2 inch outside diameter, minimum 0.05 inch wall thickness, concealed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
    - c. Length and Configuration: As indicated on drawings.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. Verify that field measurements are as indicated on drawings.

#### **3.02 PREPARATION**

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

#### **3.03 INSTALLATION**

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
  - 1. Grab Bars: As indicated on drawings.
  - 2. Mirrors: 40 inch, measured from floor to bottom of mirrored surface.
  - 3. Other Accessories: As indicated on drawings.

#### **3.04 PROTECTION**

- A. Protect installed accessories from damage due to subsequent construction operations.

**END OF SECTION**

## **SECTION 10 44 00 – SIGNAGE**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Interior Code Required Signage.

#### **1.02 REFERENCE STANDARDS**

- A. California Building Code, Chapter 11B-703
- B. Americans With Disabilities Act Accessibility Guidelines (ADAAG) and local amendments and modifications.

#### **1.04 SUBMITTALS**

- A. Product Data: Submit data on signage describing size, finish, details of function, and attachment methods.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. The following may be used to fabricate signage:
  - 1. 3Form
  - 2. APCO Graphics, Inc.
  - 3. Architectural Sign Group
  - 4. 3M Commercial Graphics Division
  - 5. ASI Sign Systems
  - 6. Ampersand Contract Signing Group
  - 7. Substitutions: Section 01 60 00 - Product Requirements.

#### **2.02 MATERIALS**

- A. Code Required Information Signs: Standard Signs shall meet Code and fabricated as indicated on Drawings.
  - 1. Tactile Graphics and Text: Provide tactile copy and/or grade 2 Braille raised 1/32 inch minimum from plaque surface using manufacturer's co-molding process as detailed on drawings.
    - a. Provide lettering and graphics precisely formed, uniformly opaque to comply with relevant ADA regulations and requirements indicated for size, style, spacing, content, position, and colors.
  - 2. Colors: High contrast semi-matte integral colors for graphics. All integral resins are U.V. stabilized resins utilizing automotive grade pigments. Visual characters shall be contrasting with the background surface.
- B. Lettering shall be Arial upper and lower case, dye cut or computer cut, roller applied, color as indicated on Drawings.

#### **2.03 SIGN MOUNTING HARDWARE**

- A. Adhesive approved for the signage and substrate the sign is being installed on.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify exact location of signage for installation.
- C. Verify that field measurements are as indicated on drawings.

#### **3.02 INSTALLATION**

- A. Install product in accordance with supplier's instructions.

- B. Install product in locations indicated using mounting methods recommended by sign manufacturer and free from distortion, warp, or defect adversely affecting appearance.
- C. Install product level, plumb, and at heights indicated.
- D. Install product at heights to conform to Americans with Disabilities Act Accessibility Guidelines (ADAAG) and applicable local amendments and regulations.
- E. Install signs within 1/4 inch vertically and horizontally of intended location.

#### **3.04 PROTECTION**

- A. Repair scratches and other damage which might have occurred during installation. Replace components where repairs were made but are still visible to the unaided eye from a distance of 5 feet.
- B. Remove temporary coverings and protection to adjacent work areas. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project.

END OF SECTION

## **SECTION 12 36 00 - COUNTERTOPS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Countertops for architectural cabinet work.
- B. Countertops for manufactured casework.
- C. Wall-hung counters and vanity tops.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 41 00 - Architectural Wood Casework.

#### **1.03 REFERENCE STANDARDS**

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).
- C. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

#### **1.04 SUBMITTALS**

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Specimen warranty.
- B. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.
- C. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- D. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

#### **1.06 FIELD CONDITIONS**

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

### **PART 2 PRODUCTS**

#### **2.01 COUNTERTOPS**

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
  - 1. Laminate Sheet, Type \_\_\_\_: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
    - a. Manufacturers:
      - 1) Arborite: [www.arborite.com/#sle](http://www.arborite.com/#sle).
      - 2) Formica Corporation: [www.formica.com/#sle](http://www.formica.com/#sle).
      - 3) Wilsonart: [www.wilsonart.com/#sle](http://www.wilsonart.com/#sle).
      - 4) Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Back and End Splashes: Same material, same construction.

- C. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
  - 1. Flat Sheet Thickness: 3/4 inch, minimum.
  - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
    - a. Manufacturers:
      - 1) Avonite Surfaces: [www.avonitesurfaces.com/#sle](http://www.avonitesurfaces.com/#sle).
      - 2) Dupont: [www.corian.com/#sle](http://www.corian.com/#sle).
      - 3) Formica Corporation: [www.formica.com/#sle](http://www.formica.com/#sle).
      - 4) Wilsonart: [www.wilsonart.com/#sle](http://www.wilsonart.com/#sle).
      - 5) Substitutions: See Section 01 60 00 - Product Requirements.
    - b. Color and Pattern: As indicated on drawings.
  - 3. Other Components Thickness: 1/2 inch, minimum.
  - 4. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.

## **2.02 MATERIALS**

- A. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

## **2.03 FABRICATION**

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
  - 1. Join lengths of tops using best method recommended by manufacturer.
  - 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
  - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
  - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
  - 2. Height: 4 inches, unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.
- D. Wall-Mounted Counters: Provide braces as indicated on drawings.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### **3.03 INSTALLATION**

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

- B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.
- C. Seal joint between back/end splashes and vertical surfaces.

#### **3.04 CLEANING**

- A. Clean countertops surfaces thoroughly.

#### **3.05 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

## **SECTION 13 31 00 - FABRIC STRUCTURES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Custom tensioned fabric structure, including fabric, structural steel supporting members, fittings, and accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete foundations.
- B. Section 05 12 00 - Structural Steel Framing: Additional requirements for support steel.

#### **1.03 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.

#### **1.04 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data, including test reports on fabric showing compliance with specified properties.
- B. Shop Drawings: Submit construction drawings including plans, elevations, details, dimensions, support steel sizing, cables and hardware, clamp/corner plates, fittings, fabric, fabric layout seams, and the following:
  - 1. Exact interface geometry determination and definitions.
  - 2. Coordination between fabric and structural supports
  - 3. Interfaces to foundation supports.
  - 4. Design loads used in structural calculations.
  - 5. Foundation reaction loads.
  - 6. Stamp or seal of design engineer.
- C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Firm that is capable of assuming complete responsibility for design, engineering, fabrication, delivery, preparation, installation, adjusting, cleaning of structure, and the following:
  - 1. Having minimum of five years experience in design and fabrication of tensioned fabric structures of similar size and complexity to that specified.
  - 2. Employing a professional staff and qualified consultants experienced with tensioned fabric structures of similar size and complexity to that specified.
  - 3. Employing integrated CAD and finite element computer software programs to ensure adequacy of design and accurate 3-dimensional computer generated models for fabrication of structure; using CAD system to prepare construction drawings and interface with the plotting and cutting process, ensuring high precision fabric cutting.
  - 4. Providing installation directly supervised by a superintendent, directly employed by contractor, with five years of experience in installation of tensioned fabric structures of similar size and complexity to that specified.

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

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Store materials in accordance with manufacturer's instructions, in a clean, dry, well ventilated area, above ground on blocking, and do not allow materials to become wet, stained, or dirty.
- C. Handle materials so as to protect materials, coatings, and finishes during handling and installation to prevent damage or staining.
  - 1. Handle fabric in accordance with manufacturer's instructions.
  - 2. Use care in handling of fabric to avoid damage to fabric material and coating.

3. Do not damage, crush, or kink cables.

#### **1.07 WARRANTY**

- A. Provide manufacturer's standard ten year fabric warranty.
- B. Provide installer's written one year workmanship warranty.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Tensioned Fabric Structures:
  1. Birdair, Inc; \_\_\_\_\_: [www.birdair.com](http://www.birdair.com).
  2. Membrane Structure Solutions, Inc; \_\_\_\_\_: [www.membranestructuresolutions.com](http://www.membranestructuresolutions.com).
  3. Span Systems, Inc; \_\_\_\_\_: [www.spansystemsinc.com/#sle](http://www.spansystemsinc.com/#sle).
  4. USA Shade: [www.usa-shade.com](http://www.usa-shade.com)
  5. Substitutions: See Section 01 60 00 - Product Requirements.

#### **2.02 TENSIONED FABRIC STRUCTURES**

- A. Tensioned Fabric Structure: Provide a custom tensioned fabric structure consisting of fabric stretched on steel structural supports, with the following characteristics:
  1. Capable of withstanding loads specified in ASCE 7 and local building code without damage or failure; for designer's information, project falls under the following design categories:
  2. Capable of maintaining structural integrity in event of a tear propagating in fabric, without endangering occupants.
  3. Shape geometry selected for equilibrium based on stress in fabric.
  4. Having a smooth uniform fabric surface with even curved edges and interfaces and without wrinkles, cuts, abrasions, stains, marks, surface defects, or seaming aberrations.
  5. Configuration as indicated on drawings.
  6. Made of prefabricated components ready for installation.

#### **2.03 MATERIALS**

- A. Supporting Steel Members: As specified in Section 05 12 00, unless otherwise specified in this section; steel members are hot-dipped galvanized after fabrication.
- B. Paint for Structural Steel Members, Tensioning Nuts, and Fabric Plates:
- C. Cables and End Fittings: Provide structural cables of same type having same modulus of elasticity.
  1. Cables in Contact with Fabric: PVC sleeved.
  2. Cable Length Tolerance: As indicated on drawings.
  3. Swaged and Speltered Fittings: Design and install to develop full breaking strength of cable.
  4. Thimble End Fittings: Design and install to develop a minimum of 90 percent of breaking strength of cable.
  5. Swaged End Fittings, Pins, Nuts, and Washers: Stainless steel.
  6. Tensioning Nuts and Fabric Plates: Galvanized steel, finished with two coats of epoxy paint.
- D. Shackles, Rigging Screws, Clamps, and Tensioning Hardware: Stainless steel architectural finished material only.
- E. Interior Lighting: Predrill base plates to allow conduit to be installed and cabling to run inside support steel for mounting lights under canopy.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine area to receive structure; notify Architect if area is not acceptable, and do not begin installation until unacceptable conditions have been corrected.
- B. Examine foundations and anchor bolts for location and elevation; notify Architect of inaccuracies, and do not begin installation until unacceptable conditions have been corrected.



### **3.02 PREPARATION**

- A. Prepare an erection plan for all structural and fabric installation activity, including a detailed sequence of the work.
- B. Prepare a clear, flat, smooth, and clean layout area on ground of sufficient size for assembly of fabric panels; prepare area adjacent to location of structure installation.
- C. Check contact surfaces to remove sharp objects, dirt, grease, oil, and other causes for rips, scratching, or other damage to fabric panels during installation.
- D. Use temporary ground sheets where fabric panels are to be dragged across a surface to prevent chaffing or other damage to fabric panel surface.

### **3.03 INSTALLATION**

- A. Comply with pre-established erection plan.
- B. Do not undertake erection of fabric during inclement weather conditions; installer has sole responsibility to determine when conditions are safe for erection.
- C. Install structure in accordance with manufacturer's instructions at location indicated on drawings.
- D. Install structure in necessary sequence and with sufficient bracing to ensure stability throughout installation.
- E. Architect will inspect installed concrete foundations, support steel, cables, and fittings before installation of fabric only to ensure compliance with data submittals.
- F. Install and tension fabric in accordance with manufacturer's instructions.
  - 1. Use care in installation of fabric to avoid damage to base material, coating, and surface treatment.
  - 2. Ensure surfaces of fabric are smooth, uniform, and clean, with even curved edges and interfaces, and with no cuts, scratches, abrasions, stains, marks, blemishes, or welding irregularities.
- G. Repair or replace defective or damaged materials, coatings, and finishes as directed by Architect.

### **3.04 ADJUSTING**

- A. Make final adjustments to structure as required for structural integrity, geometric shape, and free from objectionable wrinkles when viewed from the normally occupied space.

### **3.05 CLEANING**

- A. Clean structure in accordance with fabric manufacturer's instructions.

**END OF SECTION**

**SECTION 22 05 00**  
**COMMON WORK RESULTS FOR PLUMBING**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Project Specification, apply to this and the other sections of Division 22.
- B. This Division is an integrated whole comprising interrelated and interdependent Section and shall be considered in its entirety in determining requirements of the Work.
- C. Refer to other sections of this Division for additional requirements or information regarding the subjects of this Section.

**1.02 SECTION INCLUDES**

- A. This Section includes general administrative and procedural requirements for plumbing installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01:
  - 1. Submittals.
  - 2. Coordination drawings.
  - 3. Record documents.
  - 4. Maintenance manuals.
  - 5. Rough-ins.
  - 6. Mechanical installations.
  - 7. Cutting and patching.

**1.03 SUBMITTALS**

- A. General: Follow the procedures specified in Division 01.
- B. Plumbing submittals shall include shop drawings, product data, and samples per requirements of each section of specification
- C. Plumbing Submittals and Product Data: Assemble "submittals" and "product data" into tabbed brochures according to main areas of work.
  - 1. Assemble each brochure with tabbed separators for each Specification Section where products are noted to be submitted, with separate tabs for each product listed.
  - 2. Temperature "control shop drawings" may be submitted separately after preparations for review.
  - 3. For items such as valves, hangers and accessories, indicate specific items and where they are to be used.
  - 4. Contractor need only to submit for review those items specified to be submitted, unless requested by the Architect for special review.
- D. All final submittals to Owner shall be a hard copy, electronic submittals are not acceptable.
- E. Increase the number of plumbing related submittals including; shop drawings, product data, and samples submitted to allow for required distribution by one additional copy, which will be retained by the Mechanical Consulting Engineer.
- F. Submit for review, only the specific items required in this Section or other Sections of Division 22.
- G. Additional submittals shall include, but not limited:
  - 1. Equipment data record drawings.
  - 2. Certification of completion of testing.
  - 3. Certification of completion of operation instructions.
  - 4. Operating instruction brochure.
  - 5. Maintenance instruction brochures.
  - 6. Equipment guarantees.

## COMMON WORK RESULTS FOR PLUMBING

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7. 1/4" = 1'-0" or larger scale layouts of "Equivalent" equipment or "Or Approved Equal" equipment.
  8. Coordination Drawings, where requested or required.
- H. Submittal materials will be reviewed for substantial conformity with the intent of the contract plans and specifications only. Such review does not indicate approval of dimensions, quantities, coordination with other trades, or work methods of the contractor, which are indicated thereon.
- I. Additional copies may be required by individual sections of these specifications.

### 1.04 COORDINATION

- A. The Contractor shall be totally responsible for coordinating the layout of all building elements to avoid conflict of the work of the structural, mechanical, electrical systems, and architectural features of the building.
- B. The cost of any extra work of any kind caused by a conflict due to this lack of coordination shall be borne by the Contractor.

### 1.05 COORDINATION OF DRAWINGS

- A. Prepare coordination drawings in accordance with requirements of Project Specification to a scale of 1/4" = 1'-0" or larger; detailing major elements, components, required clearances, and systems of plumbing equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of the installations are of importance to the efficient flow of the Work, including but not necessarily limited to the following:
1. Indicate the proposed locations of piping, fixtures, equipment, and materials. Include the following:
    - a. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
    - b. Equipment for connections and support details.
  2. Prepare reflected ceiling plans to coordinate and integrate installations with other systems and components, such as, ductwork, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.
- B. Submittal of "Or Equal" substitutions of equipment will not be reviewed unless accompanied by coordination drawings.

### 1.06 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements of project specification. In addition to the requirements of project specification, indicate the following installed conditions:
1. Record drawings of all installed systems as specified in project specification including the locations and invert elevations of underground installations.

### 1.07 MAINTENANCE MANUALS

- A. Prepare maintenance manuals in accordance with project specification and Division 22 Section "Supplementary Plumbing Requirements".

### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, mill certification, and other information needed for identification.

### 1.09 EQUIVALENT EQUIPMENT

- A. In these specification and drawings, whenever more than one (1) manufacturer's product is specified, the manufacturer specified on the drawings and the first named product in these specifications is the basis of design and the use of alternate-named manufacturer's product or substitutes may require modification in the design work and agency approvals. If such alternatives or substitutions are proposed by the contractor, contractor shall adhere to the following requirements;
1. Contractor shall clearly identify all proposed alternatives or substitutions in the submittal package.

## COMMON WORK RESULTS FOR PLUMBING

22 05 00 - 3

2. The Contractor shall assume all costs required to make all necessary revisions and modifications of the contract documents resulting from the substitution or selection of an alternate manufacturer's product, including all professional fees and the cost of DSA approval.
3. The Contractor shall assume all costs required for any additional modification to building structure, electrical and all other related construction costs resulting from the substitution or selection of an alternate manufacturer's product
- B. These specifications and/or drawings, names and specifies certain equipment in detail which are the basis of design and are explained in paragraph 1.09-A above. It also names alternate equipment by manufacturer, which is not considered to be a "substitution".
- C. Submit equivalent equipment to the Architect for review per the requirements of Division 01, and Section "Supplementary Plumbing Requirements."
- D. Equipment of Manufacturers named in Division 22 will be considered equivalent to that specified in detail and/or named on the drawings if:
  1. The proposed equipment is of equivalent quality, capacity.
  2. Equipment is as fully equipped, fits the space allotted, and has physical configuration and weight similar to the equipment specified in detail.
- E. A complete lay out of an equipment room or area must be submitted for equivalent equipment. Notice space limitations. Layouts to include plans and section views at a scale of not less than 1/4" = 1 ft.
- F. The Architect shall determine the acceptability of "Equivalent Equipment."

### **PART 2 - PRODUCTS (Not Applicable)**

### **PART 3 - EXECUTION**

#### **3.01 ROUGH-IN**

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

#### **3.02 MECHANICAL INSTALLATIONS**

- A. General: Sequence, coordinate, and integrate the various elements of plumbing systems, materials, and equipment. Comply with the following requirements:
  1. Coordinate plumbing systems, equipment, and materials installation with other building components.
  2. Verify all dimensions by field measurements.
  3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for plumbing installations.
  4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
  5. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
  6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible as required by California Building Code.
  7. Coordinate connection of plumbing system with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
  8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect prior to commencement of installation.

## COMMON WORK RESULTS FOR PLUMBING

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9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.
10. Install all plumbing equipment to facilitate servicing, maintenance, and repair or replacement of equipment components in full compliance with California Building Code and the equipment manufacturer's recommendations. If the drawings or the manufacturer does not provide a specific space requirement for servicing equipment, provide as a minimum, horizontal distance of 36" from face of equipment to opposite vertical surface.
11. Install access panels or doors for all equipment and components which require access for adjustment and maintenance, where units are concealed behind finished surfaces.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Any equipment located above a ceiling that has any component, which is serviceable shall be installed within 12" of the top of the ceiling.

### 3.03 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with project specification. In addition to the requirements specified in project specification, the following requirements apply:
  1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- B. Perform cutting, fitting, and patching of plumbing equipment and materials required to:
  1. Uncover Work to provide for installation of ill-timed Work.
  2. Remove and replace defective work.
  3. Remove and replace Work not conforming to requirements of the Contract Documents.
  4. Remove samples of installed Work as specified for testing.
  5. Install equipment and materials in existing structures.
  6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
- C. Cut, remove and legally dispose of selected plumbing equipment, components, and materials as indicated, including but not limited to removal of plumbing piping, gas lines, heating units, plumbing fixtures and trim, and other plumbing items made obsolete by the new Work.
- D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed
- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
  1. Patch existing finished surfaces and building components using experienced installers and new materials matching existing materials. For installer's qualifications refer to the materials and methods required for the surface and building components being patched.

**END OF SECTION**

**SECTION 22 05 03  
EARTHWORK FOR PLUMBING SYSTEMS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. This Section includes limited scope instructions for methods and materials applicable to excavation for underground utilities and services, including underground piping under the building and from building to utility connection, tanks, basins, and equipment.

**1.02 SUBMITTALS**

- A. Submit schedules in accordance with Conditions of Contract and Divisions 01 and 22 Specification sections.
  - 1. Indicate proposed methods and schedule of operations prior to commencement of work.
  - 2. Include coordination for shut off of utility services where required.
  - 3. Maintain services to areas outside construction limits, where such service exists.
  - 4. Coordinate sequencing with construction phasing and Owner occupancy specified in Division 01.

**1.03 DEFINITIONS**

- A. Excavation consists of removal of material encountered to sub-grade elevations indicated and subsequent disposal of materials removed.
- B. Unauthorized excavation consists of removal of materials beyond indicated sub-grade elevations or dimensions without specific direction of Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be at Contractor's expense.
- C. Sub-grade: The undisturbed earth or the compacted soil layer immediately below granular sub-base drainage fill, or topsoil materials.
- D. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

**1.04 CODES AND ORDINANCES**

- A. Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

**1.05 PROJECT CONDITIONS**

- A. Conditions Affecting Excavations: The following project conditions apply:
  - 1. Maintain and protect existing building services which transit the area affected by selective demolition.
  - 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
- B. Site Information: Subsurface conditions were investigated during the design of the Project. Reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information.
- C. Existing Utilities: Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations. Remove existing underground utilities indicated to be removed.
- D. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair

## EARTHWORK FOR PLUMBING SYSTEMS

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damaged utilities to satisfaction of utility owner.

- E. Use of Explosives: Use of explosives is not permitted.

### 1.06 SEQUENCE AND SCHEDULING

- A. Coordinate the shut off and disconnection of utility services with Owner and utility company.
- B. Provide minimum of 48-hour notice to Architect prior to utility interruption.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Select Bedding Sand: Dry river bed sand free of any debris or organic matter.
- B. Mastic Coatings: "Henry's" oil base roof mastic or approved equal.
- C. Polyethylene sheeting not less than 8 mils thick.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Examine areas where earthwork is to occur. Determine extent of work and effect on existing conditions to remain. Advise Architect of any conditions that might create extensive alteration beyond indicated scope.
- B. Clearances: Take special notice and maintain the required horizontal and vertical depth clearances from structural footings for utility trenches running parallel to footings. Do not violate the area of the footing bearing prism. In the event of conflict (i.e., the utility cannot be relocated or its depth changed), proceed as directed by the Architect. Lower structural footings to maintain proper clearances for underground utilities trenching without additional cost to Owner.

### 3.02 EXCAVATION

- A. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.
- B. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
  - 1. Remove shoring/bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at a height of 30 inches below finished grade elevation.
- C. Install sediment and erosion control measures in accordance with local codes and ordinances.

### 3.03 DEWATERING

- A. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
  - 1. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.
  - 2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

### 3.04 MATERIAL STORAGE

- A. Material Storage: Stockpile satisfactory excavated materials where directed until required for backfill or fill. Place grade and shape stockpiles for proper drainage.
  - 1. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
  - 2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.

EARTHWORK FOR PLUMBING SYSTEMS  
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### 3.05 TRENCHING

- A. Do all necessary trenching, excavation, shoring and backfilling required for the proper laying of the pipe lines.
- B. Pipe Trench Dimensions: The following requirements are considered minimal unless otherwise indicated, in order to provide adequate pipe clearances and bedding. Provide trenches wider than the specified minimum where required to properly install the particular type of piping. In the event utility company regulations, code requirements, or the pipe manufacturer's recommendations differ from these provisions, the most restrictive requirements shall take precedence.
1. Pipe Burial Depths:

Sewer & Drainage:	24"(a) + pipe O.D.(b) + 3" bed of sand
Gas:	30" + pipe O.D. + 4" bed of sand
Water (Domestic)	
PVC:	30" + pipe O.D. + 4" bed of sand
All other:	24" (30" at planters) + pipe O.D. + 4" bed of sand
Pre-insulated Piping	24" + jacket O.D. + 4" bed
Condenser Water (PVC)	30" + pipe O.D. + 4" bed

Notes:

    - a. Finish grade to top of pipe, typical.
    - b. O.D.: Outside dimension.
  2. Trench Widths:

Sewer & Drainage:	12" + pipe O.D. for 4" to 18" diameter pipe
Gas:	8" + pipe O.D.
Water (Domestic)	8" + pipe O.D.
Water (Fire)	
Pre-insulated Pipe	8" + jacket O.D.
Condenser Water	8" + pipe O.D.
- C. Where rock is encountered, carry excavation below required elevation and backfill with a layer of select bedding sand prior to installation of pipe. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and pipe.
- D. Excavate trenches for piping and equipment with bottoms of trench to accurate elevations for support of pipe and equipment on undisturbed soil.
- E. Do not install copper piping or metal gas piping in a common trench with other dissimilar metal piping or conduit; separate a minimum of 4 feet when running parallel to such piping or conduit.
- F. Separate multiple parallel lines of piping in a common trench a minimum of 12 inches, both horizontally and vertically, between individual pipes.
- G. Install domestic water piping, running parallel in a common trench with sewer or drainage lines, on a solid shelf 12 inches above the sewer or drainage piping.
- H. Do not run electrical power and communications conduit in a common trench with sewer, drainage, water or gas piping.
- I. Provide and install a bare 14 gauge copper "tracer" wire, continuous for entire length, for all underground non-metallic piping. Secure to piping at alternate joints, at each fitting and at each valve. Locate "Tracer" wire along-side pipe, but not under pipe.
- J. Install thrust blocks in all pressurized lines. Install thrust blocks in accordance with pipe manufacturer's recommendations.

### 3.06 EXCAVATION FOR UNDERGROUND CLARIFIERS AND STRUCTURES

- A. Excavation for Underground Tanks, Basins, and Mechanical Structures: conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot; plus a



## EARTHWORK FOR PLUMBING SYSTEMS

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sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

1. Excavate, by hand, areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch in diameter larger with emulsified asphalt tree paint.
2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.

### 3.07 BACKFILLING AND FILLING

- A. Backfilling and Filling: Place soil materials in layers to required sub-grade elevations for each area classification listed below, using materials specified in Part 2 of this Section.
- B. Bedding: Lay and bed pipe in compacted select dry river-bed bedding sand, thickness as specified herein and backfill with the same sand material to a height of one foot above the top of pipe.
  1. Sewer drain lines except as hereinafter specified may be bedded in the native soil provided it is rock free and sandy. Dig out under bell portions of the piping for uniform bearing.
  2. Under walks and pavements, use a combination of sub-base materials and excavated or borrowed materials.
  3. Under building slabs, set piping on a 6-inch bed of dry river-bed sand and backfilled to 12" of finish grade with dry river-bed sand. Remainder of backfill to be approved backfill material.
  4. Under piping and equipment, use sub-base materials where required over rock bearing surface and for correction of unauthorized excavation.
  5. For piping less than 30 inches below surface of roadways, provide 4-inch-thick concrete base slab support. After installation and testing of piping, provide a 4-inch thick concrete encasement (sides and top) prior to backfilling and placement of roadway sub-base.
  6. Other areas use excavated or borrowed materials.
- C. Backfill excavations as promptly as work permits, but not until completion of the following:
  1. Do not backfill until installation has been approved and as-built drawings are up to date.
  2. Inspection, testing, approval, and locations of underground utilities have been recorded.
  3. Removal of concrete formwork.
  4. Removal of shoring and bracing, and backfilling of voids.
  5. Removal of trash and debris.
- D. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- E. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage as specified in Division 02. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- F. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping and equipment by carrying material uniformly around them to approximately same elevation in each lift.
- G. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 deg. F.
- H. Unauthorized excavation:
  1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Architect.

EARTHWORK FOR PLUMBING SYSTEMS  
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2. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Architect.

**3.08 SUBSIDENCE**

- A. Subsidence: Where subsidence occurs at mechanical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

**3.09 CORROSION PROTECTION**

- A. All below ground metallic fittings, valves, flanges, bolts, pipes (which are not factory coated with a bituminous material) shall be protected against corrosion as follows:
  1. All metallic components as described above shall receive a heavy coating of "Henry's" oil base roof mastic.
  2. After mastic coating is completed and inspected, wrap entire metallic component with a minimum of 8 mil polyethylene wrap overlapped 50% of the circumference and extended beyond ends of component as required for polyethylene to be secured to piping. The overlap seam shall be located to avoid backfill material from entering the encapsulated area. The ends and seam of the polyethylene material shall be secured to the piping and sealed with 3M Scotch/Wrap N. 50, 10 mil., 2" wide, printed, pipe wrap sealing tape.
  3. The mastic coating shall be inspected and approved prior to the finish application of the polyethylene material, which shall also be inspected.

**END OF SECTION**

**SECTION 22 05 11**  
**SUPPLEMENTARY PLUMBING REQUIREMENTS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. This Section specifies supplementary requirements for plumbing installations and includes requirements common to more than one section of Division 22. It expands and supplements the requirements specified in Section 22 05 00 "Common Work Results for Plumbing."

**1.02 DESCRIPTION**

- A. Provide a complete and operable installation, including all labor, supervision, materials, equipment, tools, apparatus, transportation, warehousing, rigging, scaffolding and other equipment and services necessary to accomplish the work in accordance with the intent and meaning of these drawings and specifications.

**1.03 COORDINATION**

- A. Coordination of the work is the responsibility of the Contractor.
- B. Contractor shall designate an individual competent and versed in the plumbing trades to coordinate the plumbing work with the work of other trades.

**1.04 DEFINITIONS (AS USED ON DIVISION 22 DRAWINGS AND HEREIN)**

- A. "Provide" means furnish, install and connect unless otherwise described in specific instances.
- B. "Piping" means pipes, fittings, valves and all like pipe accessories connected thereto.
- C. "Extend", "Submit", "Repair" and similar words mean that the Contractor (or his designated subcontractor) shall accomplish the action described.
- D. "Codes" or "Code" means all codes, laws, statutes, rules, regulations, ordinances, orders, decrees, and other requirements of all legally constituted authorities and public utility franchise holders having jurisdiction.
- E. "Products", "Materials" and "Equipment" are used interchangeably and mean materials, fixtures, equipment, accessories, etc.
- F. "Utility Areas" are defined as mechanical, electrical, janitorial, and similar rooms or spaces which are normally used or occupied only by custodial or maintenance personnel. "Public Areas" are defined as the rooms or spaces, which are not included in the utility areas definition.
- G. "Building Boundary" includes concrete walkways immediately adjacent to the building structure.
- H. "Below Grade" means buried in the ground.
- I. "Substantial Completion" means all components of all systems are functioning but lacking in final adjustment.
- J. Pressure rating specified (such as for valves and the like) means design working pressure for and with references to the fluid, which the device will serve.

**1.05 RELATED WORK**

- A. Coordination: Refer to Architectural, HVAC, Plumbing, Civil, Structural, and Electrical Drawings for the construction details and coordinate the work of this Division with that of other Divisions. Order the work of this Division so that progress will harmonize with that of other Divisions and all work will proceed expeditiously. The work of this Division shall include direct responsibility for the correct placing and connection of Plumbing work in relation to the work of other Divisions.
- B. Examine other Divisions for work related to the Work of this Division, especially Divisions 23 & 26.

**1.06 EXISTING CONDITIONS**

- A. Visit the site prior to bidding and investigate the existing conditions, which affect or will be affected by the work of this Division. Become thoroughly familiar with the working conditions and take into account any special or unusual features peculiar to this job. By the act of submitting a Bid, the Contractor will be deemed to have complied with the foregoing, to have accepted such conditions, and to have made allowance therefore in preparing his Bid.
- B. The locations of existing concealed utility lines are shown in accordance with reference data received by the Architect. The Architect does not guarantee the accuracy of such data. The points of connection are therefore approximate and the Bidder shall include adequate funds in his Bid to cover costs of connection regardless of their exact location.
- C. Exercise extreme caution during trenching operations. Repair the damage caused by such operations to existing utility lines at no cost to the Owner, whether the lines are shown on drawings or not.

**1.07 DRAWINGS AND SPECIFICATIONS**

- A. These drawings and specification do not include necessary components for construction safety.
- B. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".
- C. Except where dimensioned, the drawings relating to this division are a diagrammatic presentation of the design concept, which indicates the general area where piping is to be run. The drawings do not necessarily indicate any and all offsets and configurations required for coordination with other trades. The contractor is responsible for the correct placing of his work, and the proper location and connection of his work in relation to the work or other trades.

**1.08 WATER (DOMESTIC AND FIRE), SANITARY SEWERS AND NATURAL GAS SERVICES**

- A. Within 5 days after award of Contract, notify the serving utilities that the project is under construction and apply for permanent service in the name of the Owner. Furnish pertinent load and location information to them including the required dates for permanent service. Verify service locations and conform to utility company requirements.
- B. Contractor shall pay charges for permanent service connections levied by the utilities for which he will be reimbursed by the Owner. The reimbursement shall be limited to the actual amount of the utility service charges and a copy of the billing from the utility company shall accompany the Contractor's invoice.

**1.09 PERMITS AND INSPECTIONS**

- A. Obtain, schedule and pay for permits, licenses, approvals, tests, and inspections required by legally constituted authorities and public utility franchise holders having jurisdiction over the work.
- B. Afford the Architect's representative every facility for evaluating the skill and competence of the mechanics and to examine the materials. Concealed work shall be reopened when so directed during his periodic visits.

**1.10 CODES AND REGULATIONS**

- A. By submitting a Bid, Contractor is deemed to represent himself as competent to accomplish the work of this Division in conformance with applicable Codes. In case of conflict between the Contract Documents and Code requirements, the Codes shall take precedence. Should such conflicts appear, cease work on the parts of the contract affected and immediately notify the Architect in writing.  
It shall be the Contractor's responsibility to correct, at no cost to the Owner, any work he executes in violation of Code requirements. Specific references to codes elsewhere in this Division are either to aid the Contractor in locating applicable information or to deny him permission to use options, which are permitted by Codes.

SUPPLEMENTARY PLUMBING REQUIREMENTS  
22 05 11 - 3

- B. Applicable Codes: (Current editions unless otherwise noted)
1. All local codes; City and/or County as applicable.
  2. OSHA requirements
  3. California Building Code
  4. California Code of Regulations (CCR) Titles (as applicable)
  5. Fire Marshal Regulations
  6. State, County, City Health Department Ordinances and Regulations
  7. Regulations of all other authorities having jurisdiction.
  8. California Mechanical Code.
  9. California Plumbing Code.
- C. Where conflict or variation exists amongst Codes, the most stringent shall govern.

**1.11 RECORD AND DOCUMENTATION**

- A. Accumulate the following and deliver to the Owner's representative prior to final acceptance of the work.
1. Record (As-Built) Drawings:
    - a. Maintain in good order in the field office a complete set of prints for all work being done under Division 22. Update the drawings daily with neat and legible annotations in red ink showing the work as actually installed.
    - b. The actual size, location and elevation of all buried lines, valve boxes, manholes, monuments, and stubouts shall be accurately located and dimensioned from building walls or other permanent landmarks.
    - c. Furnish the original marked up AS-Built drawings and an electronic copy in AutoCAD-14 format.
  2. Operation and Maintenance Manual: Furnish an operation and maintenance manual covering the stipulated Plumbing systems and equipment. Seven copies of the manual, bound in hardback binders or an approved equivalent shall be provided to the Architect.
  3. Furnish one complete manual prior to the time that system or equipment tests are performed.
  4. Furnish the remaining manuals before the contract is completed.
  5. The following identification shall be inscribed on the cover:

OPERATION AND MAINTENANCE MANUAL  
PROJECT TITLE . . . . .  
CONTRACTOR NAME & CONTACT INFORMATION
  6. Provide a Table of Contents.
    - a. Insert tab sheets to identify discrete subjects.
    - b. Instruction sheets shall be legible and easily understood, with large sheets of drawings folded in.
    - c. The manual shall be complete in all respects for all materials, piping, valves, devices and equipment, controls, accessories and appurtenances stipulated. Include as a minimum the following:
      - 1) Updated approved materials lists, shop drawings and catalog information of all items of HVAC system equipment.
      - 2) System layout showing piping, valves and controls.
      - 3) Wiring and control diagrams with data to explain detailed operation and control of each component.
      - 4) A control sequence describing start-up, operation and shutdown.
      - 5) Detailed description of the function of each principal component of the system.
      - 6) Procedure for starting.
      - 7) Procedure for operating.
      - 8) Shut-down instructions.
      - 9) Installation instructions.
      - 10) Adjustments, maintenance and overhaul instructions.

## SUPPLEMENTARY PLUMBING REQUIREMENTS

22 05 11 - 4

- 11) Lubrication schedule including type, grade, temperature range and frequency.
  - 12) Safety precautions, diagrams and illustrations.
  - 13) Test procedures.
  - 14) Performance data.
  - 15) Parts lists, with manufacturer's names and catalog numbers.
  - 16) Preventive maintenance schedule.
  - 17) Service organization with name, address and telephone number.
  - 18) Valve identification chart and schedule.
  - 19) ASME certificates.
  - 20) Hydronic balance report.
- B. Standards Compliance: Where equipment or materials are specified to conform to requirements of standards of recognized technical or industrial organizations such as American National Standards Institute (ANSI) American Society for Mechanical Engineers (ASME) American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), American Society for Testing Materials (ASTM), Underwriters Laboratories (UL), American Gas Association (AGA), American Society of Plumbing Engineers (ASPE), American Refrigeration Institute (ARI), or National Electrical Manufacturer's Association (NEMA), that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and approved. The label or listing of the specified organization will be acceptable evidence.
- C. Certificates of Conformance or Compliance: Submit original and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply that the product does not meet all requirements.
- D. Certified Test Reports: Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of materials and equipment, submit certified copies of test reports specified in the individual sections.
- E. Factory Tests: Factory tests are tests, which are required to be performed on the actual materials or equipment, proposed for use. Submit results of the tests in accordance with the requirements for laboratory test results of this Contract.
- F. Permits and Certificates of Inspection: Furnish the originals.
- G. Testing procedures and test results required in this and other sections. Furnish 2 copies.
- H. Other data required by other sections of this Division. Furnish 2 copies.

### 1.12 CONSTRUCTION COST BREAKDOWN

- A. Prepare and submit for review a construction cost breakdown for the major subdivisions of the PLUMBING?? work in accordance with General and Supplemental Conditions and Project Specification.
- B. Subdivide each item on the breakdown into two headings: labor and materials. Include overhead and profit in each entry.
- C. Submit one copy of the breakdown directly to the Engineer and the remaining copies sent through regular channels.

### 1.13 TOOLS

- A. Provide all special tools needed for proper operation and routine adjustment and maintenance of systems and equipment. Deliver tools to Owner's representative and request a receipt for same.

### 1.14 WARRANTIES

- A. Refer to Project Specification for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

## SUPPLEMENTARY PLUMBING REQUIREMENTS

22 05 11 - 5

- B. Where periods more than one year are specified in the specifications, such longer periods shall govern. However, when any component fails at any time during this period, the warranty period for such component and all other components, which are inactive because of, said failure shall be suspended. The warranty period for such components shall resume to run for the remaining portion of the warranty period when failed component is completely repaired and in operation; however, in no case shall the resumed portion of the warranty period be less than 3 months in duration.
- C. Neither payment for work, nor total or partial occupancy of work by the Owner, within or prior to the warranty period specified, shall be construed as acceptance of faulty work or shall condone any negligence or omission of Contractor in doing the work.
- D. Compile and assemble the warranties specified in Division 22, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.
- E. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names and addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

### 1.15 SEISMIC RESTRAINT

- A. Provide seismic restraint for plumbing equipment, piping, and accessories.
- B. Contractor shall submit certification of suitability of seismic restraint methods signed by Licensed Structural Engineer registered in the State of California.

### 1.16 SYSTEM OPERATIONAL TESTS

- A. The Contractor shall inform the Owner one week prior to start of testing in order that the Owner's representative may be present.
- B. After balancing and prior to final inspection, the contractor shall operate all plumbing systems trouble free and stable. Contractor shall submit a written report certified by the Owner's representative indicating the successful completion of a stable and trouble free testing.

## PART 2 - PRODUCTS

### 2.01 MATERIALS AND EQUIPMENT

- A. Standard Products: Materials and equipment shall be essentially the standard cataloged products of manufacturers regularly engaged in production of such materials or equipment and shall be their latest standard designs that comply with the specification requirements.
- B. Materials and equipment shall duplicate items that have been in satisfactory commercial or industrial use at least two years prior to bid opening, unless more stringent requirements are specified. Where two or more units of the same type of equipment are required, these units shall be products of a single manufacturer. The components thereof, however, are not required to be exclusively of the same manufacturer.
- C. Each major component of equipment shall have manufacturer's name, address, model, and serial number on a nameplate securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.
- D. In these specification and drawings, whenever more than one (1) manufacturer's product is specified, the manufacturer specified on the drawings and the first named product in these specifications is the basis of design and the use of alternate-named manufacturer's product or substitutes shall comply with the requirements of Section 22 05 00.

### 2.02 PRODUCT LISTING

- A. When two or more items of same material or equipment are required (pipe and fittings, plumbing fixtures, pumps, valves, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, sheet metal, wire, steel bar stock, welding rods, solder, fasteners, and similar items used in Work, except as otherwise indicated.

## SUPPLEMENTARY PLUMBING REQUIREMENTS

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### 2.03 NAMEPLATE DATA

- A. Provide permanent operational data nameplate on each item of power operated plumbing equipment, indicating manufacturer, product name, model name, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

### 2.04 SUBSTITUTIONS

- A. General: Submittals of "Substitutions" shall be in accordance with requirements of Division 01.
- B. By proposing a substitution, it is deemed that the Contractor shall bear the cost of any and all design and construction changes (whether architectural, structural, electrical, and Plumbing) necessary to accommodate the substitution, if said substitution is accepted.
- C. Specific: Refer to Specification Sections 22 05 00 & 22 05 12 for additional requirements.

### 2.05 SUBMITTALS

- A. General: Make submittals in accordance with requirements of Division 01.
- B. Specific: Refer to Specification Sections 22 05 00 for additional requirements.

## PART 3 - EXECUTION

### 3.01 WORKMANSHIP AND INSTALLATION METHODS

- A. Workmanship shall be in the best standard practice of the trade.
- B. Install equipment in accordance with the manufacturer's instructions and recommendations unless otherwise noted or specified.

### 3.02 TESTS

- A. General:
  - 1. Demonstrate that all components of the work of this Division have been provided and that they operate in accordance with the Contract Documents.
  - 2. Provide instruments and personnel for tests and demonstrations. Submit signed test results.
- B. Specific: Refer to the other sections of this Division for test requirements.

### 3.03 DELIVERY, HANDLING, STORAGE OF MATERIALS AND PROTECTION OF WORK

- A. Protect materials against dirt, water, chemical and mechanical damages both while in storage and during construction.
- B. Cover materials in such a manner that no finished surfaces will be damaged, marred or splattered with plaster or paint, and all moving parts will be kept clean and dry.
- C. Replace or refinish any damaged materials including fronts of control panels, piping, insulation, and equipment.
- D. All plumbing fixtures, vents, and waste lines shall be aggressively protected during construction process to ensure that no contamination of the system occurs.
- E. The use of permanently installed plumbing fixtures during construction is prohibited.
- F. Keep cabinets and other openings closed to prevent entry of foreign matter.
- G. Specific: Refer to other sections of this Division for additional requirements.

### 3.04 PROJECT CONDITIONS

- A. Check and coordinate for clearance, accessibility and placement of equipment either by going through openings provided or by placing equipment during construction. Ordering of equipment to be shipped disassembled, or disassembly of equipment at Project Site and reassembly of equipment to accomplish this requirement shall be executed without additional cost.



## SUPPLEMENTARY PLUMBING REQUIREMENTS

22 05 11 - 7

Where provided openings are inadequate to accommodate equipment, provide new openings and restoration of same, all at no additional cost. Obtain written approval for new openings before proceeding.

- B. Verify location of all plumbing fixtures and equipment within finished spaces with the Architectural Drawings. In the event that Plumbing Drawings do not indicate exact locations, or are in conflict with the Architectural Drawings, obtain information regarding proper locations. Installation of work without proper instruction under such circumstances will result in relocation of work, when directed, without additional cost.

### 3.05 INSTRUCTION TO OWNER PERSONNEL

- A. Contractor shall furnish, without additional expense to the Owner, the services of competent instructors who will give full instruction to the designated personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the equipment or system specified. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance of work. Instruction shall be given at the Owner's convenience. The number of man-days (eight-hours) of instruction furnished shall be as specified in other sections. When more than four man-days of instruction are specified, approximately half of the time shall be used for classroom instruction. All other time shall be used for instruction with the equipment or system. When significant changes or modifications are made under the terms of the contract, provide additional instructions to acquaint the operating personnel with the changes or modifications.
- B. Contractor shall videotape, both visual and audio, instruction to Owner's personnel on the maintenance and operation of the plumbing equipment and systems.
- C. Submit certification, signed by Owner's agent that instructions have been completed and the videotape has been reviewed and delivered to the Owner.
- D. Printed operating instructions and a copy of wiring diagrams are to be mounted in all equipment areas, framed and behind glass or encased in plastic. Printed operating instructions shall include steps for starting up and securing equipment. As a precedent to final acceptance four (4) copies of instructions are to be submitted to the Architect for review. Contractor shall turn over to Owner in a neat brochure form, equipment guarantee and maintenance instructions.

### 3.06 CLEANING

- A. Cleaning shall be done as the work proceeds. Periodically remove waste and debris to keep the site as clean as is practical.
- B. Refer the Division 01 for general requirements for cleaning.
- C. Leave exposed parts of the plumbing work in a neat and clean condition, with painted surfaces unblemished and plated metal surfaces polished.
- D. Thoroughly clean all materials, equipment and appliances. Clean and prepare all surfaces to be painted. Clean the entire premises of unused materials, debris, spots and marks to the satisfaction of the Architect.
- E. Remove, thoroughly clean and replace all strainers and valves after the system has been put in operation until system is clear of all foreign matter and repeat this operation after ten (10) days and again after the system has been in operation thirty (30) days. Submit certification that this operation has been completed.

### 3.07 SAFETY REQUIREMENTS

- A. Enclose and guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts in accordance with OSHA requirements. Insulate, guard, and cover any high-temperature equipment and piping so located as to endanger personnel or create a fire hazard.

## END OF SECTION

WD 20624

FILLMORE HIGH SCHOOL  
MODERNIZATION

01/26/2021

**SECTION 22 05 12**  
**PLUMBING PRODUCT SUBSTITUTIONS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. This Section specifies administrative and procedural requirements for handling requests made after award of the Contract for substitutions of products specified in Division 22.

**1.02 RELATED SECTIONS**

- A. Procedure for Contractor's construction Schedule and the Schedule of Submittals are included under Division 01.
- B. Standards: Refer to Division 01 for applicability of industry standards to products specified.
- C. Procedural requirements governing the Contractor's selection of products and product options are included under Division 01.
- D. Refer to Division 01 for Products and Substitutions.
- E. Refer to Sections 22 05 00 & 22 05 11 for additional requirements.

**1.03 DEFINITIONS**

- A. "Products" is defined to include purchased items for incorporation into the work, regardless of whether specifically purchased for project or taken from Contractor's stock of previously purchased products. "Materials" is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, installed or applied to form units of work.
- B. "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, etc.). Definitions in this paragraph are not intended to negate the meaning of other terms used in contract documents, including "specialties", "systems", "structure", "finishes", "accessories", "furnishings", "special construction", and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

**1.04 SUBSTITUTIONS**

- A. The requirements for substitutions do not apply to specified Contractor options on products and construction methods. Revisions to contract documents, where requested by Owner, Architect or Engineer, are "changes" not "substitutions". Substitutions requested during bidding period, which have been accepted prior to Contract Date, are included in contract document and are not subject to requirements for substitutions as specified herein. Contractor's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute "substitutions"; and do not constitute a basis for change orders, except as provided for in contract documents. Otherwise, contractor's requests of changes in products, materials and methods of construction required by contract documents are considered requests for "substitutions", and are subject to requirements hereof.
- B. Conditions: The Contractor's substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.
  - 1. Extensive revisions to Contract Documents are not required.
  - 2. Proposed changes are in keeping with the general intent of Contract Documents.
  - 3. The request is directly related to an "or approved equal" clause or similar language in the Contract Documents.
  - 4. All costs required to make all necessary revisions and modifications to the contract documents resulting from the substitution, including but not limited to, all professional fees and the cost of DSA approval will be the Contractor's responsibility.

## PLUMBING PRODUCT SUBSTITUTIONS

22 05 12 - 2

5. All costs required to make all necessary revisions and modifications to the building structure, electrical and all other related construction costs resulting from the substitution, including but not limited to, material, products, equipment, testing, and inspection will be the Contractor's responsibility.
6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
7. Contractor will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.
8. Contractor certifies that the substitution is not heavier than the specified item and does not necessitate any structural and electrical redesign; will fit within the room or area designed for the specified item; and will not exceed any maximum dimensions specified or shown on the original contract Documents. All roof mounted equipment must be less than or equal to the maximum height dimension from the finished roof as shown on the drawings.
9. Contractor represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified.
10. Contractor represents that he will provide the same warranty for the substitution that he would for that specified.

### 1.05 SUBMITTALS

- A. Requests for Substitutions: Any request for substitution shall follow the guidelines of Substitution Requirements in Division 01, Section 22 05 00 & 22 05 11.
- B. Substitution Warranty: All submittals of Request for Substitutions under the General and Supplementary Conditions of this Section shall be accompanied by a completely executed (filled out) and signed Substitution Warranty in the form entitled "Substitution Warranty", bound herein. Substitutions will not be accepted without the Substitution Warranty. In addition to other requirements, Contractor shall warrant in writing on his own letterhead that substituted materials shall perform as specified, and assume complete responsibility for same, including responsibility and costs required for modifications to building or other materials or equipment, and any additional coordination with work of other trades. Testing, if required, shall be paid by Contractor.
- C. Responsibility of Contractor: The contractor shall be solely and directly responsible for fitting accepted substitute material and equipment into the available space in a manner acceptable to the Architect, and for the proper operation of the substituted equipment with all other equipment with which it may be associated. The Contractor shall bear all costs of meeting the above requirements for presenting a proposed substitution, and if the substitution is accepted, he must bear all costs involved.
- D. Submit the following as part of the Request for Substitutions:
  1. Data showing proposed equipment is "equal" to that specified and is fully equipped, fits the space allotted and has physical configuration and weight similar to the equipment specified in detail.
  2. A complete layout, where applicable, of equipment room or area must be submitted for equipment proposed in "Request for Substitution". Submittal shall conform to requirements of Division 01 and Section 22 05 00 "Common Work Results for Plumbing" as it applies to "Coordination Drawings."
  3. Seismic Restraint: Where seismic restraint is required for products or equipment as specified, methods of seismic restraint signed by licensed Structural Engineer registered in the State of California, shall be submitted for review to the Division of the State Architect.

### 1.06 ARCHITECT'S ACTION

- A. The Architect may request additional information or documentation necessary for evaluation of the request. Requests, by the Architect, for additional information or documentation will be in accordance with Division 01 requirements.

## PLUMBING PRODUCT SUBSTITUTIONS

22 05 12 - 3

The Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, Contractor shall use the "Basis of Design" product specified by name in the contract documents. Acceptance will be in the form of a Change Order.

### **PART 2 - PRODUCTS**

#### **2.01 SUBSTITUTIONS**

- A. Substitutions shall conform to the product requirements for the specified products or equipment.

### **PART 3 - EXECUTION (Not Applicable)**

**END OF SECTION**

PLUMBING PRODUCT SUBSTITUTIONS

22 05 12 - 4

**SAMPLE  
SUBSTITUTIONS WARRANTY**

In addition to other requirements, Contractor shall warrant in writing that substituted materials shall perform as specified, and assume complete responsibility for same, including responsibility and costs required for modifications to building or other materials or equipment, and any additional coordination with work of other trades. Testing, if required, shall be paid by contractor. The following is an example of the type Substitution Warranty which shall be executed by the Contractor, on his own letterhead:

**SUBSTITUTION WARRANTY**

We propose to provide

\_\_\_\_\_  
(Describe items being proposed for substitution)

for \_\_\_\_\_ in lieu of  
(List project name)

as indicated on the drawings and described in Section \_\_\_\_\_ of the Specifications.

We agree to assume the cost of any and all modifications to the Contract Documents and to other portions of the work as indicated in the Specification Sections 22 05 00, 22 05 11, & 22 05 12, and as necessary to accommodate for substituted material(s) and system(s) as indicated in this letter of "Substitution Warranty."

We hereby warrant that \_\_\_\_\_  
(Provide Description)

is the equivalent of \_\_\_\_\_  
(Specified Product)

in every respect and will perform satisfactorily under the conditions and use indicated on the Drawings and described in the Specifications.

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

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

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

NOTE: Affix Corporate Seal over Signatures.

**SECTION 22 05 14  
SELECTIVE PLUMBING DEMOLITION**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. This Section includes limited scope of selective Plumbing demolition work as follows:
  - 1. Nondestructive removal of materials and equipment for reuse or salvage as indicated.
  - 2. Dismantling Plumbing fixtures, materials and equipment made obsolete by these installations.

**1.02 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 and Division 22 Specification Sections.
- B. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut-off of utility services and details for dust and noise control.
  - 1. Coordinate sequencing and Owner occupancy specified in Division 01.
  - 2. Coordinate other selective demolition work as outlined in Division 01.

**1.03 PROJECT CONDITIONS**

- A. Conditions Affecting Selective Demolition: The following project conditions apply:
  - 1. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
  - 2. Locate, identify, and protect plumbing services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas. Provide minimum of 72-hour notice to Owner prior to utility interruption.

**1.04 SEQUENCE AND SCHEDULING**

- A. Coordinate the shut-off and disconnection of utility services with the Owner and the utility company.
- B. Notify the Architect at least 7 days prior to commencing demolition operations.
- C. Perform demolition in phases as indicated.

**PART 2 - PRODUCTS (Not Applicable)**

**PART 3 - EXECUTION**

**3.01 EXAMINATION**

- A. Examine areas where selective demolition is to occur. Determine extent of work and affect on existing conditions to remain. Advise Architect of any conditions that might create extensive alterations beyond indicated scope.

**3.02 SELECTIVE DEMOLITION**

- A. General: Demolish, remove, demount, and disconnect abandoned Plumbing fixtures, materials and equipment indicated to be removed and not indicated to be salvaged or saved.

## SELECTIVE PLUMBING DEMOLITION

22 05 14 - 2

- B. Materials and Equipment to be Salvaged: Remove, demount, and disconnect existing Plumbing fixtures, materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.
  - 1. Protect all removed and salvaged equipment from being damaged during the demolition work.
- C. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.
- D. Plumbing Materials and Equipment: Demolish, remove, demount, and disconnect the following items:
  - 1. Inactive and obsolete, piping, fittings and specialties, equipment, controls, fixtures, and insulation.
    - a. Obtain written approval from Architect and owner for piping embedded in floors, walls, and ceilings which may remain, if such materials do not interfere with new installations.
      - 1) Drain and cap piping allowed to remain.
    - b. Remove materials above accessible ceilings.
  - 2. Perform cutting and patching required for demolition.

**END OF SECTION**

**SECTION 22 05 15**  
**ACCESS DOORS AND PANELS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. This Section includes limited scope of general construction materials and methods for access doors and panels in walls and ceilings for access to plumbing materials.
- B. Requirements of access doors are outlined in Division 08.
- C. Access doors and panels are required for all plumbing equipment requiring maintenance, inspection, adjustment, monitoring, etc... which are installed in inaccessible areas such as behind walls, above ceiling, under floor, etc...

**1.02 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of access door or panel.

**1.03 QUALITY ASSURANCE**

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer Qualifications: Engage an experienced Installer for the installation of access panels and doors.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:
  - 1. Elmdor / Stoneman.
  - 2. Jay R. Smith Mfg. Co.
  - 3. Milcor Inc.
  - 4. Or equal.

**2.02 ACCESS DOORS**

- A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
- B. Frames: 16-gage steel, with a 1-inch-wide exposed perimeter flange.
  - 1. For installation in masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling: 1 inch-wide-exposed perimeter flange and adjustable metal masonry anchors.
  - 2. For gypsum wallboard or plaster: perforated flanges with wallboard bead.
  - 3. For full-bed plaster applications: galvanized expanded metal lath and exposed casing bead, welded to perimeter frame.
- C. Flush Panel Doors: 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.
  - 1. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.
- D. Locking Devices: Flush, screwdriver-operated cam locks.

**PART 3 - EXECUTION**

**3.01 EXAMINATION**

- A. Examine areas and conditions under which access door and panel products are to be installed. Do not proceed with work until unsatisfactory conditions have been in manner acceptable to Installer.



## ACCESS DOORS AND PANELS

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### 3.02 APPLICATION

- A. Nonrated Walls and Ceilings: Prime coat finish door and frame, Allen key latch face of wall type; Smith 4760, Elmdor / Stoneman DW Series.
- B. Fire Rated Walls and Ceilings: "B" Labeled U.L. 1-1/2 hours, prime coat finish door and frame, flush keyed cylinder lock; Milcor.
- C. Tile Walls: Cover and frame 18-8 satin stainless steel, face-of-wall type, vandal resistant screws; J. R. Smith 4762, Elmdor / Stoneman DW Series

### 3.03 INSTALLATION OF ACCESS DOORS

- A. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
- B. Adjust hardware and panels after installation for proper operation.

### 3.04 COORDINATION

- A. General: Coordinate locations of ceilings access doors with lights, air outlets, speakers, etc. Submit drawings showing relative locations of doors to other ceiling items for acceptance by the Architect prior to installation. Transparencies of floor plans and/or reflected ceiling plans will be available from the Architect for this purpose.
- B. Location: Doors may be located to serve more than one item where feasible, providing they are approved as specified. Sizes suitable for purpose intended, with 12" x 12" minimum.
- C. Access doors and panels not required in accessible ceiling systems where direct access to plumbing items is possible.

**END OF SECTION**

**SECTION 22 05 23**  
**GENERAL DUTY VALVES FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. This Section includes general duty valves common to most mechanical piping systems.
  - 1. Special purpose valves are specified in individual piping system specifications.

**1.02 RELATED SECTIONS**

- A. Division 22 Section "Plumbing Identification" for valve tags and charts.

**1.03 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract, Division 01 Specification Sections, and Section 22 05 00 "Common Work Results for Plumbing."
  - 1. Product data, including body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.
  - 2. Provide valve schedule showing manufacturer's figure number and sizes.

**1.04 QUALITY ASSURANCE**

- A. Single Source Responsibility: Comply with the requirements specified in Division 01 Section "Materials and Equipment," under "Source Limitations."
- B. American Society of Mechanical Engineers (ASME) Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.
- C. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Compliance: Comply with the various MSS Standard Practices referenced.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Preparation For Transport: Prepare valves for shipping as follows:
  - 1. Ensure valves are dry and internally protected against rust and corrosion.
  - 2. Protect valve ends against damage to threads, flange faces, and weld-end preps.
  - 3. Set valves in best position for handling. Set globe and gate valves closed to prevent ratting; set ball and plug valves open to minimize exposure of functional surfaces; and block swing check valves in either closed or open position.
- B. Storage: Use the following precautions during storage:
  - 1. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.
  - 2. Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. Manufacturer: Subject to compliance with requirements, provide products from one of the manufacturers listed in valve schedule.

**2.02 VALVE FEATURES, GENERAL**

- A. Valve Design: Rising stem or rising outside screw and yoke stems.
  - 1. Non-rising stem valves may be used where headroom prevents full extension of rising stems.
- B. Pressure and Temperature Ratings: As scheduled and required to suit system pressures and temperatures.
- C. Sizes: Same size as upstream pipe, unless otherwise indicated.
- D. Operators: Provide the following special operator features:

GENERAL DUTY VALVES FOR PLUMBING PIPING  
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1. Hand wheels, fastened to valve stem, for valves other than quarter turn.
  2. Lever handles, on quarter-turn valves 6-inch and smaller, except for plug valves. Provide plug valves with square heads; provide one wrench for every 10 plug valves.
  3. Chain-wheel operators, for valves 2-1/2 inch and larger, install 72 inches or higher above finished floor elevation. Extend chains to an elevation of 5'-0" above finished floor elevation.
  4. Gear drive operators, on quarter-turn valves 8-inch and larger.
- E. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.
- F. End Connections: As indicated in the valve specifications.
1. Threads: Comply with ANSI B1.20.1.
  2. Flanges: Comply with ANSI B16.1 for cast iron, ANSI B16.5 for steel, and ANSI B16.24 for bronze valves.
  3. Solder-Joint: Comply with ANSI B16.18.
    - a. Caution: Where soldered end connections are used, use solder having a melting point below 840 deg. F for gate, globe, and check valves; below 421 deg. F for ball valves.

### 2.03 GATE VALVES

- A. Gate Valves, 2-Inch and Smaller: MSS SP-80; Class 150, body and union bonnet of ASTM B62 cast bronze; with threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron hand wheel. Do not use solder end valves for hot water heating or steam piping applications.

MANUFACTURER	THREADED NRS	THREADED RS	SOLDER NRS	SOLDER RS
Crane	X	431UB	X	X
Grinnell	3050	3060	X	X
Milwaukee	1141	1151	X	1169
Nibco	T-136	T-135	S-136	X
KITZ	X	42	X	43

"X" means not available. Provide lead-free products.

- B. Gate Valves, 2-1/2 Inch and Larger: MSS SP-70; Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A126 class B; with flanged ends, "Teflon" impregnated packing, and two-piece backing gland assembly.

MANUFACTURER	OS & Y RS	NRS
Crane	465-1/2	461
Grinnell	6020A	6060A
Nibco	617-O	F-619
Milwaukee	F-2885	F-2882
KITZ	72	75

"X" means not available. Provide lead-free products.

### 2.04 BALL VALVES

- A. Ball Valves, 2 Inches and Smaller: Rated for 150 psi saturated stem pressure, 400 psi WOG pressure; two- or three-piece construction; with bronze body conforming to ASTM B 62, full port only, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout-proof stem, and vinyl covered steel handle. Provide solder ends for condenser water, chilled water, and domestic hot and cold water service; threaded ends for heating hot water and low-pressure steam.

1. Ball Valves - 1 Inch and Smaller:

GENERAL DUTY VALVES FOR PLUMBING PIPING  
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MANUFACTURER	THREADED ENDS	SOLDER ENDS
Crane	9302	9322
Nibco	T-580-70	S-580-70
Watts	B-6000	B-6001
Milwaukee	BA-100	BA-150
KITZ	58	59

"X" means not available. Provide lead-free products.

2. Ball Valves - 1-1/4 Inch to 2 Inch:

MANUFACTURER	THREADED ENDS	SOLDER ENDS
Nibco	T-590-Y	S-590-Y
Stockham	S-216 BR-R-T	S-216-BR-R-S
Watts	B-6800	B-6801
KITZ	62	63

"X" means not available. Provide lead-free products. Grooved Ends: Victaulic Style 721.

## 2.05 PLUG VALVES

- A. Plug Valves, 2-Inch and Smaller: Rated at 150 psi WOG; bronze body, with straightaway pattern, square head, and threaded ends.
  1. Lunkenheimer: 454 or equal.
  2. Homestead: 611 (Semi Steel Body) or equal.
- B. Plug Valves, 2-1/2 Inch and Larger: MSS SP-78; rated at 175 psi WOG; lubricated plug type, with semi steel body, single gland, wrench operated and flanged ends.
  1. Powell: 2201 or equal.
  2. Homestead: 605 or equal.

## 2.06 CHECK VALVES

- A. Swing Check Valves, 2-Inch and Smaller: MSS SP-80; Class 125, cast-bronze body and cap conforming to ASTM B 62; with horizontal swing, Y-pattern, and bronze disc; and having threaded or solder ends. Provide valves capable of being reground while the valve remains in the line. Provide Class 150 valves meeting the above specifications, with threaded end connections, where system pressure requires or where Class 125 valves are not available.

MANUFACTURER	CLASS 125 THREADED ENDS	CLASS 125 SOLDER ENDS	CLASS 125 THREADED ENDS
Crane	37	1342	137
Milwaukee	509	1509	510
Nibco	T-413	S-413	T-433
KITZ	22	23	29

Grooved Ends: Victaulic Series 712. Provide lead-free products.

- B. Swing Check Valves, 2-1/2 Inch and Larger: MSS SP-71; Class 125 (Class 175 FM approved for fire protection piping systems), cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal wing, and bronze disc or cast-iron disc with bronze disc ring; and flanged ends. Provide valves capable of being refitted while the valve remains in the line.

MANUFACTURER	CLASS 125	CLASS 175
Crane	373	X
Milwaukee	F2974	X
Nibco	F-918	X
KITZ	78	X

"X" means not available. Provide lead-free products.

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- C. Lift Check Valves, 2-Inch and Smaller: Class 125; cast-bronze body and cap conforming to ASTM B 62; horizontal or angle pattern, lift-type valve, with stainless steel spring, bronze disc holder with renewable "Teflon" disc, and threaded ends. Provide valves capable of being refitted and ground while the valve remains in the line.

MANUFACTURER	HORIZONTAL	ANGLE
Jenkins	655-A	X
Lunkenheimer	233	X

"X" means not available. Provide lead-free products.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Examine valve interior through the end ports for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks used to prevent disc movement during shipping and handling.
- B. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the shipping position.
- C. Examine threads on both the valve and the mating pipe for form (i.e., out-of-round or local indentation) and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.
- E. Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials, and proper alignment.
- F. Replace defective valves with new valves.

#### 3.02 VALVE ENDS SELECTION

- A. Select valves with the following ends or types of pipe/tube connections:
  - 1. Copper Tube Size, 2-Inch and Smaller: Solder ends, except provide threaded ends for heating hot water and low-pressure steam service.
  - 2. Steel Pipe Sizes, 2-Inch and Smaller: threaded or grooved end.
  - 3. Steel Pipe Sizes 2-1/2 Inch and Larger: grooved end or flanged.

#### 3.03 VALVE INSTALLATIONS

- A. General Application: Refer to piping system specification sections for specific valve applications and arrangements. Use gate, ball, and butterfly valves for shut-off duty. Use globe, plug, and ball valves for throttling duty.
- B. Locate valves for easy access and provide separate support where necessary. Where concealed, install behind access panel with valve located for complete accessibility for servicing.
- C. Install valves and unions for each fixture and item of equipment. Arrange valves to allow equipment removal without system shutdown. Unions are not required on flanged devices.
- D. Install three-valve bypass around each pressure reducing valve using throttling-type valves.
- E. Install valves in horizontal piping with stem at or above the center of the pipe.
- F. Install valves in a position to allow full stem movement.
- G. Installation of Check Valves: Install for proper direction of flow as follows:
  - 1. Swing Check Valves: Horizontal position with hinge pin level.
  - 2. Lift Check Valve: With stem upright and plumb.
- H. Where shut-off valves are installed in a confined space such as in a wall or furring, install ball valves with operating handle parallel with face of wall.

GENERAL DUTY VALVES FOR PLUMBING PIPING  
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- I. Where valves are located in walls, do not install more than 6'-0" from finished floor. Where valves are located above ceilings, install centered on access point and not greater than 24" above access point.

**3.04 SOLDER CONNECTIONS**

- A. Cut tube square and to exact lengths.
- B. Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket in same manner.
- C. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.
- D. Open gate and globe valves to full open position.
- E. Remove the cap and disc holder of swing check valves having composition discs.
- F. Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to ensure even distribution of the flux.
- G. Apply heat evenly to outside of valve around joint until solder will melt upon contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.
- H. Use 95-5 tin/antimony lead-free solder for all solder joints unless indicated otherwise.

**3.05 THREADED CONNECTIONS**

- A. Note the internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.
- B. Align threads at point of assembly.
- C. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).
- D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

**3.06 FLANGED CONNECTIONS**

- A. Align flange surfaces parallel.
- B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

**3.07 FIELD QUALITY CONTROL**

- A. Tests: After piping systems have been tested and put into service, but before final adjusting and balancing, inspect valves for leaks. Adjust or replace packing to stop leaks; replace valves if leak persists.

**3.08 ADJUSTING AND CLEANING**

- A. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.

**3.09 VALVE PRESSURE/TEMPERATURE CLASSIFICATION SCHEDULES**

- A. Below schedules are for standard installation conditions. Variations or special valves and/or conditions set forth in other Division 15 Sections shall take precedence.

1. VALVES, 2-INCH AND SMALLER

SERVICE	GATE	GLOBE	BALL	CHECK
Condenser Water	125	125	150	125
Chilled Water	125	125	150	125
Domestic Hot and Cold Water	125	125	150	125
Heating Hot Water	150	150	150	150

GENERAL DUTY VALVES FOR PLUMBING PIPING  
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2. VALVES, 2-1/2 INCH AND LARGER

SERVICE	GATE	GLOBE	BUTTERFLY	CHECK
Condenser	125	125	200	125
Chilled Water	125	125	200	125
Domestic Hot and Cold Water	125	125	200	125
Heating Hot Water	125	125	200	125
Low-Pressure Steam	125	125	200	125

**END OF SECTION**

**SECTION 22 05 29  
SUPPORTS AND ANCHORS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Extent of supports and anchors required by this section is indicated on drawings or in other Division 22 sections and include the following:
  - 1. Horizontal Piping Hangers and Supports;
  - 2. Vertical Piping Clamps;
  - 3. Hanger-Rod Attachments;
  - 4. Building Attachments;
  - 5. Saddles and Shields;
  - 6. Miscellaneous Materials;
  - 7. Anchors;
  - 8. Equipment Supports.

**1.02 RELATED SECTIONS**

- A. This section is part of each Division 22 section making reference to or requiring supports and anchors specified herein.
- B. Supports and anchors furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 22 sections.
- C. Section 033000: Cast-in-Place Concrete.

**1.03 QUALITY ASSURANCE**

- A. Codes and Standards:
  - 1. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.
  - 2. UL and FM Compliance: Provide products which are UL-listed and FM approved.
  - 3. MSS Standard Compliance:
    - a. Provide pipe hangers and supports of which materials, design, and manufacturer comply with MSS SP-58.
    - b. Select and apply pipe hangers and supports, complying with MSS SP-69.
    - c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
    - d. Terminology used in this section is defined in MSS SP-90.

**1.04 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURED UNITS**

- A. Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS SP-58.
  - 1. Components shall have galvanized coatings where installed for piping and equipment that will not have field-applied finish.
  - 2. Pipe attachments shall have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Thermal Hanger Shield Inserts: 100-psi average compressive strength, waterproofed calcium silicate, encased with a sheet metal shield. Insert and shield shall cover entire circumference of the pipe and shall be of length indicated by manufacturer for pipe size and thickness of insulation.



**2.02 HORIZONTAL PIPING HANGERS AND SUPPORTS**

- A. General: Except as otherwise indicated, provide factory fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
1. Adjustable Steel Clevis Hangers: MSS Type 1.
  2. Adjustable Swivel Pipe Rings: MSS Type 6.

**2.03 VERTICAL PIPING CLAMPS**

- A. General: Except as otherwise indicated, provide factory fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
- B. Two-Bolt Riser Clamps: MSS Type 8.

**2.04 HANGER ROD AND BUILDING ATTACHMENTS**

- A. General Hanger Rod Attachment: Refer to structural drawings for requirements of hanger rod and building attachments. If a specific attachment that is required is not detailed on the structural drawings, one of the following attachments may be submitted for review by the structural engineer prior to installation. Except as otherwise indicated, provide factory fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachment to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
- B. General Building Attachment: Except as otherwise indicated, provide factory fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
1. Concrete Inserts: MSS Type 18.
  2. Center Beam Clamps: MSS Type 21.
  3. Steel Beam Clamps W/Eye Nut: MS Type 28.
  4. Linked Steel Clamps W/Eye Nut: MSS Type 29.
  5. Malleable Beam Clamps: MSS Type 30.
  6. Steel Brackets: One of the following for indicated loading:
  7. Light Duty: MSS Type 31.

**2.05 SADDLES AND SHIELDS**

- A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
- B. Protection Shields: MSS Type 40; provide high density insert of same thickness of insulation.

**2.06 MANUFACTURERS OF HANGERS AND SUPPORTS**

- A. Manufacturers: Subject to compliance with requirements, provide hangers and supports of one of the following:
1. B-Line Systems, Inc.
  2. Tolco, Inc.
  3. Elcen Metal Products Co.

## SUPPORTS AND ANCHORS

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4. Fee & Mason Mfg. Co.; Div. Figgie International.
5. ITT Grinnel Corp.

### 2.07 MISCELLANEOUS MATERIALS

- A. Steel Plates, Shapes and Bars: ASTM A36.
- B. Cement Grout: Portland cement (ASTM C150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.
- C. Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.
- D. Pipe Roll Stand: Factory fabricated cast iron stand, size as required, with insulation installed on piping.

### 2.08 ISOLATORS

- A. Isolators: Provide factory-fabricated isolators of size required.
- B. Spring Isolators: Refer to Section 22 05 48 VIBRATION CONTROL.
- C. Manufacturers: Semco "Trisolator" or Potter-Roemer PR-ISO.

## PART 3 - EXECUTION

### 3.01 INSPECTION

- A. Examine substrates and conditions under which supports and anchors are to be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachment.
- B. Prior to installation of hangers, supports, anchors and associated work, installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

### 3.03 INSTALLATION OF BUILDING ATTACHMENTS

- A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top of inserts.

### 3.04 INSTALLATION OF HANGERS AND SUPPORTS

- A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacing complying with MSS SP-69.

Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

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- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and type as installed for adjacent similar piping.
- C. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.
- D. Provisions of Movement: Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors.
- E. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- F. Pipe Slopes: Install hangers and supports to provide required pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
- G. Bare Piping: Install isolators for all bare domestic water and bare hydronic piping.
- H. Insulated Piping: Comply with the following installation requirements.
  - 1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
  - 2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields. Provide rigid insulation reinforcement at shields.
- I. Hangers and supports to be capable to resist the minimum seismic forces indicated in drawings.

### 3.05 EQUIPMENT SUPPORTS

- A. Concrete housekeeping bases will be provided as work of Division 03.
- B. Furnish to Contractor, scaled layouts of all required bases, with dimensions of bases, and location to column center lines. Furnish templates, anchor bolts, and accessories, necessary for base construction.

### 3.06 ADJUSTING AND CLEANING

- A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
- B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
- D. Touch-Up Painting: Immediately after erection of anchors and supports, clean field welds and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA-1 requirements for touch-up of field-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- E. For galvanized surfaces clean welds bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A-780.

**END OF SECTION**

**SECTION 22 05 53**  
**PLUMBING IDENTIFICATION**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Extent of Plumbing identification work required by this section is indicated on drawings or specified in other Division 22 sections, and includes the following:
  - 1. Painted Identification Materials;
  - 2. Plastic Pipe Markers;
  - 3. Plastic Tape;
  - 4. Underground-Type Plastic Line Marker;
  - 5. Plastic Duct Markers;
  - 6. Valve Tags;
  - 7. Diagram and Schedule Frames;
  - 8. Engraved Plastic-Laminate Signs;
  - 9. Plastic Equipment Markers;
  - 10. Plasticized Tags.

**1.02 RELATED SECTIONS**

- A. This section is part of each Division 22 section making reference to identification devices specified herein.
- B. Plumbing identification furnished as part of factory-fabricated equipment is specified as part of equipment assembly in other Division 22 sections.
- C. Refer to Division 26 Sections for identification requirements of electrical work; not work of this section.

**1.03 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.
- B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.
- C. Schedules and Diagrams:
  - 1. Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule.
  - 2. Submit temperature control diagrams and Sequence of Operation on bond paper suitable for framing.
- D. Maintenance Data: Include product data and schedules in maintenance manuals; in accordance with requirements of Division 01 and Division 22 Section 22 05 11 "Supplementary Plumbing Requirements."

**1.04 QUALITY ASSURANCE**

- A. Codes and Standards:
  - 1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
  - 2. No adhesive type identification markers will be accepted. All markers and tags shall be permanently attached to pipe, etc.
  - 3. All identification markers installed exterior of buildings shall be ultra-violet resistant.

**PART 2 - PRODUCTS**

**2.01 ACCEPTABLE MANUFACTURERS**

PLUMBING IDENTIFICATION  
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- A. Manufacturer: Subject to compliance with requirements, provide Plumbing identification materials of one of the following:
1. Seton Name Plate Corp.
  2. Allen Systems, Inc.
  3. Brady (W.H.) Co.; Signmark Div.
  4. Industrial Safety Supply Co., Inc.

**2.02 PLUMBING IDENTIFICATION MATERIALS**

- A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 22 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.

**2.03 PLASTIC PIPE MARKERS**

- A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.
- B. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subject to fluid temperatures of 125°F (52°C) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.
- C. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
  2. Laminated or bonded application of pipe marker to pipe (or insulation).
  3. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".
- D. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
1. Laminated or bonded application of pipe marker to pipe (or insulation).
  2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2" wide; full circle at both ends of pipe marker, taped lapped 3".
  3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.
- E. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.
1. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as a separate unit of plastic.

**2.04 PLASTIC TAPE**

- A. General: Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.
- B. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.
- C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

**2.05 UNDERGROUND TYPE PLASTIC LINE MARKER**

- A. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates the type of service of buried pipe.
1. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

## **2.06 VALVE TAGS**

- A. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamped-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener.
  - 1. Provide 1-1/2" diameter tags, except as otherwise indicated.
  - 2. Fill tag engraving with black enamel.
- B. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
- C. Access panel markers: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
- D. Access Panel Markers: Provide manufacturer's standard 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hole to allow attachment.

## **2.07 DIAGRAM AND SCHEDULE FRAMES**

- A. General: For each page of schedule and/or diagrams, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

## **2.08 ENGRAVED PLASTIC LAMINATE SIGNS**

- A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, white with black core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
- B. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.
- C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

## **2.09 LETTERING AND GRAPHICS**

- A. General: Coordinate names, abbreviations and other designations used in Plumbing identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of Plumbing systems and equipment.
  - 1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

## **2.10 EQUIPMENT MARKERS**

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
  - 1. Data:
    - a. Manufacturer, product name, model number, and serial number.
    - b. Capacity, operating and power characteristics, and essential data.
    - c. Labels of tested compliances.
  - 2. Location: Accessible and visible.
  - 3. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
  - 1. Terminology: Match schedules as closely as possible.
  - 2. Data.

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3. Name and plan number.
  - a. Equipment service.
  - b. Design capacity.
  - c. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
4. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine sub-core, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
  1. Data: Instructions for operation of equipment and for safety procedures.
  2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
  3. Retain and edit subparagraph above or first subparagraph below.
  4. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
  5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.
- D. Access Panel and Door Markers: 1/16-inch thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
  1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

### **PART 3 - EXECUTION**

#### **3.01 GENERAL INSTALLATION REQUIREMENTS**

- A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finishes, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

#### **3.02 PIPING SYSTEM IDENTIFICATION**

- A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
  1. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot-non-insulated pipes.
- B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
  1. Near each valve and control device.
  2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
  3. Near locations where pipes pass through walls, floors ceilings, or enter non-accessible enclosures.
  4. At access doors, manholes similar access points which permit view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
  7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

### **3.03 UNDERGROUND PIPING IDENTIFICATION**

- A. General: During back-filling/top-soiling of each exterior underground piping systems, except sanitary sewer and storm drainage install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker.

### **3.04 VALVE IDENTIFICATION**

- A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, and similar rough-in connections of end-use fixtures and units. List each tagged valve on valve schedule for each piping system.
- B. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect/Engineer.

### **3.05 PLUMBING EQUIPMENT IDENTIFICATION**

- A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of plumbing equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
  - 1. Fuel-burning units including water heaters, boilers, furnaces, heaters.
  - 2. Pumps, compressors, chillers, condensers and similar motor-driven units.
  - 3. Fans and blowers.
- B. Lettering Size: Minimum 1/4" high lettering for name of unit where viewing distance is less than 2'-0", 1/2" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 of size of the principal lettering.
- C. Test of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

### **3.06 ADJUSTING AND CLEANING**

- A. Adjusting: Relocate any Plumbing identification device which has become visually blocked by work of this division or other divisions.
- B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

**END OF SECTION**



**SECTION 22 07 00**  
**PLUMBING INSULATION**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Extent of plumbing insulation required by this section is indicated on drawings and schedules, and by requirements of this section, and includes the following:
  - 1. Piping Systems Insulation:
    - a. Fiberglass.
    - b. Calcium Silicate.
    - c. Flexible Unicellular.
  - 2. Equipment Insulation:
    - a. Fiberglass
    - b. Calcium Silicate
    - c. Flexible Unicellular.

**1.02 RELATED SECTIONS**

- A. Refer to Division 22 Section "Supports and Anchors" for protection saddles, protection shields, and thermal hanger shields; not work of this section.
- B. Refer to Division 22 Section "Plumbing Identification" for installation of identification devices for piping and equipment; not work of this section.

**1.03 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, K-value, thickness, and furnished accessories for each mechanical system requiring insulation.
- B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

**1.04 QUALITY ASSURANCE**

- A. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.
- B. As a minimum, insulation shall meet installed conductance as set forth in Title 24 California Code of Regulations (CCR) 2013 Building Energy Efficiency Standards or as indicated in contract documents, whichever is greater.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
- B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

**PART 2 - PRODUCTS**

**2.01 ACCEPTABLE MANUFACTURERS**

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
  - 1. Owens-Corning Fiberglas Corp.
  - 2. Manville Products Corp.
  - 3. Armstrong World Industries, Inc.
  - 4. CertainTeed Corp.
  - 5. Knauf Fiber Glass GmbH.

**2.02 PIPING INSULATION MATERIALS**

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- A. Fiberglass (Mineral Fiber) Piping Insulation: ASTM C547, Class 1 unless otherwise indicated. Manville Products Corp. Micro-Lok, Owens-Corning Fiberglas Corp., ASJ/SL-II or equivalent.
- B. Calcium Silicate Piping Insulation: ASTM C533, Type I. Owens-Corning Fiberglass Corp. "Kaylo Asbestos Free" or equivalent.
- C. Flexible Unicellular Piping Insulation: ASTM C534, Type I. Armstrong World Industries, Inc. or equal meeting ASTM E-84 25/50 index.
- D. Jackets for Piping Insulation: ASTM C921, Type I (Vapor Barrier) for piping with temperatures below ambient. (Type II (Water Vapor Permeable) for piping with temperatures above ambient. Type I may be used for all piping at Installer's option.
  - 1. Encase pipe fittings insulation with one-piece pre-molded PVC fitting covers, fastened as per manufacturer's recommendations. Zeston PVC Insulated fitting covers or equivalent.
  - 2. Encase exterior piping insulation with aluminum jacket with weather-proof construction.
- E. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.
- F. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.
- G. All Insulation shall be U.L. listed showing flame spread not greater than 25, nor smoke greater than 50, per NFPA 90A.

### 2.03 EQUIPMENT INSULATION MATERIALS

- A. Flexible Fiberglass Equipment Insulation: ASTM C553, Type II, Class F-1, Owens-Corning Fiberglass, Inc., Type 701 1.5 lbs/Ft3.
- B. Calcium Silicate Equipment Insulation: ASTM C533, Type I, Block; Owens/Corning Fiberglass, Inc., Kaylo Asbestos Free, U-Grooved block insulation.
- C. Jacketing Material for Equipment Insulation: Provide canvas jacketing material, not less than 7.8 ounces per square yard, or metal jacket at Installer's option, except as otherwise indicated.
- D. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.
- E. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape corner angles, anchors and stud piping as recommended by insulation manufacturer for applications indicated.
- F. All Insulation shall be U.L. listed showing flame spread not greater than 25, nor smoke greater than 50, per NFPA 90A.

## PART 3 - EXECUTION

### 3.01 INSPECTION

- A. Examine areas and conditions under which plumbing insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

### 3.02 PLUMBING PIPING SYSTEM INSULATION

- A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, buried piping, fire protection piping, and pre-insulated equipment.
- B. Cold Piping:
  - 1. Application requirements: Insulate the following cold plumbing piping systems:
    - a. Potable chilled water piping.
    - b. Plumbing drains carrying cold condensate.

## PLUMBING INSULATION

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2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
  - a. Fiberglass: 1" thickness.
  - b. Flexible Unicellular: 1/2" thickness.
- C. Hot Piping:
  1. Application Requirements: Insulate the following hot plumbing piping systems.
    - a. Potable hot water piping.
    - b. Potable hot water re-circulating piping.
    - c. Hot drain piping (where indicated).
  2. Insulate each piping system specified above with one of the following types and thicknesses of insulation.
    - a. Fiberglass: 1" thick for pipe sizes up to and including 6", 1-1/2" thick for pipe sizes over 6".

### 3.03 EQUIPMENT INSULATION

- A. Cold Equipment (Below Ambient Temperature):
  1. Application requirements: Insulate the following cold equipment:
    - a. Refrigeration equipment, including chillers, tanks and pumps.
    - b. Drip pans under chilled equipment.
    - c. Cold and chilled water pumps.
    - d. Pneumatic water tanks.
  2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:
    - a. Fiberglass: 2" thick for cold surfaces above 35°F and 3" thick for surfaces 35°F and lower.
- B. Hot Equipment (Above Ambient Temperature):
  1. Application Requirements: Insulate the following hot equipment:
    - a. Boilers (not pre-insulated at factory).
    - b. Water heaters.
    - c. Hot water expansion tanks.
    - d. Hot water pumps.
  2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation.
    - a. Fiberglass: 2" thick, except 3" thick for low-pressure boilers and steam-jacketed heat exchangers.
- C. Breeching and Stacks:
  1. Application Requirements: Insulate the following breechings and stacks:
    - a. Breechings between heating equipment outlet and stack or chimney connection, except for double wall or factory insulated breechings.

### 3.04 INSTALLATION OF PIPING INSULATION

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.
- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.

## PLUMBING INSULATION

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- E. Maintain integrity of vapor barrier jackets on pipe insulation, and protect to prevent puncture or other damage.
- F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
- G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.

### 3.05 INSTALLATION OF EQUIPMENT INSULATION

- A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.
- B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.
- C. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.
- D. Do not apply insulation to equipment, breechings, or stacks while hot.
- E. Apply insulation using the staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.
- F. Coat insulated surfaces with layer of insulating cement, trowel in workmanlike manner, leaving a smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.
- G. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable.
- H. Do not insulate boiler manholes, hand-holes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.
- I. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.
- J. Equipment exposed to Weather: Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by the manufacturer.

### 3.06 PROTECTION AND REPLACEMENT

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

**END OF SECTION**

## **SECTION 22 10 00 PLUMBING PIPING**

### **PART 1 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. This Section specifies piping materials and installation methods common to more than one section of Division 22 and includes joining materials, fire stop sealants, and basic piping installation instructions.

#### **1.02 RELATED SECTIONS**

- A. The following sections contain requirements that relate to this section:
  - 1. Division 22 Section "Common Work Results for Plumbing" applies to this Section.
  - 2. Piping materials and installation methods peculiar to individual systems are specified within their respective system specification sections of Division 02 and 22.
  - 3. Valves are specified in a separate section and in individual piping system sections of Division 22.
  - 4. Division 22 Section "Supports and Anchors."
  - 5. Division 22 Section "Plumbing Identification."

#### **1.03 SUBMITTALS**

- A. Refer to Division 01 and Division 22 Section "Common Work Results for Plumbing" for administrative and procedural requirements for submittals.
- B. Product Data: Submit product data on fire stop sealants.

#### **1.04 QUALITY ASSURANCE**

- A. Welding procedures and testing shall comply with ANSI Standard B31.1.0 - Standard Code for Pressure Piping, Power Piping, and The American Welding Society, Welding Handbook.
- B. Soldering and brazing procedures shall conform to ANSI B9.1 Standard Safety Code for Mechanical Refrigeration.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, and clay pipe. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.
- C. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

### **PART 2 - PRODUCTS**

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

- A. Refer to the individual piping system specification Sections in Division 22 for specifications on piping and fittings relative to that particular system.
- B. Weld-O-Lets: Welding Weld-O-Lets of domestic manufacture may be used in lieu of tees where branch connection pipe size is two or more pipe sizes smaller than main header size.

#### **2.02 JOINING MATERIALS**

- A. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.
- B. Brazing Materials: Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials appropriate for the materials being joined.

- C. Soldering Materials: Refer to individual piping system specifications for solder appropriate for each respective system.
  - 1. Soldering materials shall not contain lead.
- D. Gaskets for Flanged Joints: Gasket material shall be full-faced for cast-iron flanges and raised-face for steel flanges. Select materials to suit the service of the piping system in which installed and which conform to their respective ANSI Standard (A21.11, B16.20, or B16.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

### **2.03 SLEEVES AND SEALS**

- A. Sleeves:
  - 1. Sheet-Metal Sleeves: 5" and Smaller, 20 gage galvanized sheet metal; 6" and Larger, 10 gage galvanized sheet metal, round tube closed with welded longitudinal joint.
  - 2. Steel Sleeves: Schedule 40 galvanized, welded steel pipe, ASTM A53, Grade A.
  - 3. Galvanized steel telescoping type: Galvanized sheet metal per manufacturer's standards.
  - 4. Polyethylene Sleeves: Manufacturer's standard product.
- B. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

### **2.04 FIRESTOP SEALANT**

- A. Fire stopping material shall be asbestos-free and capable of maintaining an effective barrier against flame and gases in compliance with the following requirements:
  - 1. Flame Spread: 25 or less, ASTM E 84.
  - 2. Smoke Development: 50 or less, ASTM E 84.
  - 3. Combustibility: Noncombustible, ASTM E 136.
- B. Material when installed shall have the same fire rating as the assembly in which it is being installed.

### **2.05 PIPING ISOLATION**

- A. Manufacturer's standard product for providing sound and electrolysis isolation.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Ream ends of pipes and tubes, and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris for both inside and outside of piping and fittings before assembly.

### **3.02 INSTALLATIONS**

- A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated. Refer to individual system specifications for requirements for coordination drawing submittals.
- B. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated otherwise.
- C. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- D. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated on the Drawings.

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- E. Install piping tight to slabs, beams, joists, columns, walls and other permanent elements of the building. Provide space to permit insulation applications, with 1" clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.
- F. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.
- G. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4" ball valve, and short 3/4" threaded nipple and cap.
- H. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals.
- I. Coordinate to provide curb, minimum 4" above finish floor, for all pipe shafts or floor openings for multiple pipes.
- J. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, or floors, the fire rated integrity shall be maintained.

**3.03 PIPE SUPPORTS AND HANGERS**

- A. All pipe Supports and Hangers shall be per requirements of Specification Section 22 05 29 "Supports And Anchors".

**3.04 FITTINGS AND SPECIALTIES**

- A. Use fittings for all changes in direction and all branch connections.
- B. Remake leaking joints using new materials.
- C. Install Y-type strainers with blow-down valves on the supply side of each control valve, pressure reducing or regulating valve, solenoid valve, and elsewhere as indicated.
- D. Install unions adjacent to each valve and at the final connection to each piece of equipment and plumbing fixture having 2" and smaller connections, and elsewhere as indicated.
- E. Install Flanges in piping 2-1/2" and larger, where indicated, adjacent to each valve, and at the final connection to each piece of equipment.
- F. Install dielectric unions to connect piping materials of dissimilar metals in dry piping systems (gas, compressed air, vacuum).
- G. Install dielectric fittings to connect piping materials of dissimilar metals in wet piping systems (water, steam).

**3.05 JOINTS**

- A. Steel Pipe Joints:
  - 1. Pipe 2" and Smaller: Thread pipe with tapered pipe threads in accordance with ANSI B2.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint lubricant or sealant suitable for the service for which the pipe is intended on the male threads at each joint and tighten to leave not more than 3 threads exposed.
  - 2. Pipe Larger than 2":
    - a. Weld pipe joints (except for exterior water service pipe) in accordance with ASME Code for Pressure Piping, B31.
    - b. Weld pipe joints of exterior water service pipe in accordance with AWWA C206.
    - c. Install flanges on all valves, apparatus, and equipment. Weld pipe flanges to pipe ends in accordance with ASME B31.1.0 Code for Pressure Piping. Clean flange faces and install gaskets. Tighten bolts to torque specified by manufacturer of flange and flange bolts, to provide uniform compression of gaskets.
- B. Non-ferrous Pipe Joints:
  - 1. Brazed and Soldered Joints: For copper tube and fitting joints, braze joints in accordance with ANSI B31.1.0 -Standard Code for Pressure Piping, Power Piping and ANSI B9.1 - Standard Safety Code for Mechanical Refrigeration.

2. Thoroughly clean tube surface and inside surface of the cup of the fittings, using every fine emery cloth, prior to making soldered or brazed joints.  
Wipe tube and fittings clean and apply flux. Flux shall not be used as the sole means for cleaning tube and fitting surfaces.
  3. Mechanical Joints: Flared compression fittings may be used for refrigerant lines 3/4" and smaller.
- C. Joints for other piping materials are specified within the respective piping systems sections.

### **3.06 INSTALLATION OF SLEEVES**

- A. Provide pipe sleeves for pipes to pass through walls, floor and roofs. Diameter of sleeve to be 1-inch larger than the outside diameter of pipe or pipe and covering of insulated pipe.  
Galvanized steel telescoping type sleeves or polyethylene may be used. Where seepage may occur, use steel pipe sleeves.
- B. All pipe sleeves through floors other than floors on grade shall extend 2-inches above finished floor and shall be caulked with mineral wool. Provide collar where polyethylene sleeve is used.
- C. Where required in existing construction, or where sleeves have been omitted, openings for pipe may be core drilled in floors and/or walls or partitions, providing prior acceptance of such core drilling is obtained from the Architect. Holes core drilled through floors above grade shall be provided with sleeves extending 2-inches above finish floor as hereinbefore specified.
- D. Seal with resilient sealant: Dow Corning "Fire Stop" or approved equal.

### **3.07 INSTALLATION OF FIRE STOP SEALANT**

- A. Fire-stopping shall be provided at, but not limited to, duct, and piping penetrations through floor slabs and through time rated partitions or firewalls.
- B. Install fire-stopping materials in accordance with the manufacturer's instructions and the following requirements.
  1. Filling: Fire-stopping materials shall completely fill the void spaces.
- C. Coordination: Coordinate the work with other trades. Firestopping materials at penetrations of insulated pipes and ducts shall be applied prior to insulation, unless the insulation meets the requirements specified for firestopping.
- D. Surface Preparation: Surfaces to be in contact with firestopping materials shall be free of dirt, grease, oil, loose material, rust, or other substances that may affect proper fitting or the required fire resistance.

### **3.08 INSTALLATION OF PIPE ISOLATION**

- A. Provide sound and electrolysis isolation on all un-insulated, pipes, Semco "Trisolators" or Potter-Roemer "Prisolators".

### **3.09 INSTALLATION OF PIPE FLASHING**

- A. Pipe flashing assemblies, "Semco" Fig. 1100-4, as required, seal the joint between flashing and pipe with waterproofing compound. Install counter-flashing sleeve to cover a minimum of 3/4-inch to top of lead flashing, making the top joint permanently watertight.

### **3.10 TESTING OF PIPING**

- A. Provide notification of test at least three working days prior to tests on all or part of any piping system. Do not allow or cause any piping system to be insulated, covered, concealed or enclosed until such systems have been tested and reviewed. Provide all necessary materials (including temporary isolation valves or caps), pumps, testing media and labor for testing. Temporarily remove any device in piping system, which will not withstand test pressure specified, and reinstall same after successful testing. Test time begins to accrue after full test pressure is achieved.
- B. Testing and inspection of all piping systems and associated equipment for leaks shall be accomplished after installation and cleaning and prior to placing into service. Flanges,



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threaded joints and all welds shall be left unpainted and uninsulated until the piping systems have been approved.

- C. A rigid visual inspection of each specific piping system shall be made prior to conducting tightness tests, to ascertain that all appurtenances and equipment are provided, properly connected and supported, and in all respects ready for testing.
- D. Equipment such as pumps, chillers, tanks, heat exchangers, flexible hose, safety valves and similar equipment shall not be subjected to the piping system test pressure. Equipment shall either be disconnected from the piping or be isolated by valves or blanks during testing and reinstalled after acceptance by the Owner.
- E. Indicating pressure gauges mounted locally may be tested with the lines provided the test pressure does not exceed the scale range.
- F. Orifice plates, rotometers, displacement meters and other line inserts shall either not be installed until completion of all testing, or shall be removed prior to any tests and reinstalled after test has been accepted by the Owner.
- G. The application of pressure to a system shall be under control at all times, so that in no case shall the test pressure be exceeded by more than 6 percent.
- H. Gauges used for testing shall be tested for accuracy as directed or approved by the Owner, and then installed as close as possible to the low point of the piping system.
- I. Do not apply test pressure until the piping system and its contents approach the same temperature.
- J. While piping is under test, exercise care that excessive pressure does not occur due to increase in ambient temperature.
- K. Control Valves:
  - 1. Control valves which are installed with block and by-pass valve shall have the block valve closed, the by-pass valve opened, and a temporary pipe piece inserted in place of the control valve (or a test blank may be installed on each side of the control valve) until all flushing and testing of all lines of that system is completed and accepted by the Owner, after which they shall be reinstalled.
  - 2. Control valves installed without block or by-pass valves shall be replaced by a pipe piece during flushing and testing of the system. After acceptance of the flushing they shall be reinstalled.
- L. Minimum piping test pressures shall be as noted in tabulation; or they shall be 150 percent of design pressure for the specific system being tested, whichever is higher.

SYSTEM	TEST MEDIUM	TESTING PRESSURE (PSIG)	DURATION (HOURS)	ACCEPTABLE TOLERANCE
Soil, Water, Vent, & Storm Water	Water	Top of highest vent	4	No joint sweat
Water	Water	150	4	None. Except temperature change.
Fuel Gas	Air	60	4	None. Except temperature change.
Fire Sprinkler	Water	200	4	None. Except temperature change.

- M. Conduct hydrostatic tests with water at a temperature below 100 degrees F.
  - 1. Fill the system slowly with water and vent at highest points to expel the air before pressurizing.
  - 2. Carefully examine all joints for leaks or defects.
  - 3. Provide connections as required to accomplish the above.

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- N. Keep accurate test records of each line or system tested and provide copies of same to Owner after acceptance. Each test shall include:
1. Identification of piping system and test number.
  2. Testing medium.
  3. Test pressure.
  4. Date of test acceptance.

**3.11 ADJUSTMENTS**

- A. At the completion of the Work, completely adjust all valves and equipment for their proper use and rating.

**END OF SECTION**

**SECTION 22 11 16**  
**WATER DISTRIBUTION PIPING (INSIDE BUILDING)**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. This section includes potable cold water, hot water, and circulation hot water piping, fittings, and specialties within the building to a point of 5 feet outside the building.

**1.02 RELATED SECTIONS**

- A. The following sections contain requirements that relate to this section.
  - 1. Division 22
    - a. Section 220500 "Common Work Results for Plumbing."
    - b. Section 220503 "Earthwork For Plumbing Systems."
    - c. Section 220511 "Supplementary Plumbing Requirements."
    - d. Section 220519 "Meters And Gages."
    - e. Section 220523 "Valves."
    - f. Section 220553 "Plumbing Identification."
  - 2. Division 31 Section 31 13 13.
  - 3. Division 07 Section "Joint Sealers" for materials and methods for sealing pipe penetrations through rated walls and fire and smoke barriers.
- B. Separate sections of Division 22 specify Plumbing Piping, Supports and Anchors, piping system identification materials and requirements, general duty valves, pipe insulation, fire protection piping, and plumbing equipment.

**1.03 DEFINITIONS**

- A. Water Distribution Pipe: A pipe within the building or on the premises that conveys water from the water service pipe or meter to the points of usage.
- B. Water Service Pipe: The pipe from the water main or other source of potable water supply to the water distributing system of the building served.
- C. Pipe sizes used in this Specification are nominal pipe size (NPS).

**1.04 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specifications Sections.
  - 1. Product data for each piping specialty and valve specified.
  - 2. Test reports specified in Part 3 of this Section.
  - 3. Maintenance data for each piping specialty and valve specified for inclusion in Maintenance Manual specified in Division 01 and Division 22 Section "Common Work Results for Plumbing."

**1.05 QUALITY ASSURANCE**

- A. Codes and Standards
  - 1. California Building Code 2019, Title 24, Part 2 for Accessibility Requirements.
    - a. Accessible plumbing fixtures for adults; dimensions shall comply with the requirements of CCT, T-24, Section 1115.B.
    - b. Heights and location of fixtures shall be according to CCR, T-24, Chapter 11-B and Table 1115.B-1.
    - c. Fixture Controls shall comply with CCR, T-24 Section 1115.B.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, clay pipe. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
- B. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.

## WATER DISTRIBUTION PIPING (INSIDE BUILDING)

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- C. Protect flanges, fittings and specialties, from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.
- D. Store CPVC, and PVC pipe and fittings where protected from direct sunlight.
- E. Store pipe in a manner to prevent sagging and bending.

### 1.07 SEQUENCING AND SCHEDULING

- A. Coordinate the size and location of concrete equipment pads. Cast anchor-bolt inserts into pad. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate the installation of pipe sleeves for foundation wall penetrations.

### 1.08 EXTRA MATERIALS

- A. Maintenance Stock: Furnish one valve key for each key-operated wall hydrant, hose bib, fixture supply, or faucet installed.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

- A. Manufacturer Uniformity: Conform to the requirements specified in Division 22 Section "Common Work Results For Plumbing."
  - 1. Hose Bibs:
    - a. Acorn
    - b. Woodford Mfg. Co.
    - c. Watts Regulator Co.
  - 2. Relief Valves:
    - a. Cash (A. W.) Valve Mfg. Corp.
    - b. Watts Regulator Co.
    - c. Zurn Industries, Inc. Wilkins Regulator Divs.
  - 3. Water Hammer Arresters:
    - a. Precision Plumbing Products, Inc.
    - b. Smith (Jay R.) Mfg. Co.
    - c. Sioux Chief
    - d. Watts Regulator Co.
    - e. Zurn Industries, Inc.; Hydromechanics Div.
  - 4. Vacuum Breakers for Hose Connections:
    - a. Cash (A.W.) Valve Mfg. Corp.
    - b. Conbraco Industries, Inc.
    - c. Watts Regulator Co.
  - 5. Mechanical Sleeve Seals:
    - a. Thunderline Corp.
  - 6. Pipe Escutcheons:
    - a. McGuire
    - b. BrassCraft
    - c. Pasco
  - 7. Dielectric Waterway Fittings:
    - a. Epco Sales, Inc.
    - b. Victaulic Company of America
  - 8. Dielectric Unions:
    - a. Eclipse, Inc.
    - b. Perfection Corp.
    - c. Watts Regulator Co.

### 2.02 PIPE AND TUBE MATERIALS, GENERAL

## WATER DISTRIBUTION PIPING (INSIDE BUILDING)

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- A. Pipe and Tube: Refer to Part 3, Article "Application, General," for identification of systems where the below materials are used.
- B. Copper Tube: (Within Building) ASTM B88, Type L Water Tube, drawn temper.
- C. Copper Tube: (Underground) ASTM B88, Type K Water Tube, annealed temper.

### 2.03 FITTINGS

- A. Wrought Copper Solder-Joint Fittings: ANSI B16.22, streamlined pattern.
- B. Wrought Copper and Bronze Grooved-End Fittings: ASTM B75 Tube and ASTM B584 Bronze Castings.
- C. Unions: ASME B16.39, malleable iron, Class 150, hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces, female threaded ends. Threads shall conform to ASME B1.20.1.
- D. Dielectric Unions: Threaded, solder, or grooved-end connections as required to suit application; constructed to isolate dissimilar metals, prevent galvanic action, and prevent corrosion.
- E. Dielectric Unions: Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze wire reinforced protective jacket; minimum 150 psig working pressure, maximum 250 degree F operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be 12" long and capable of 3/4-inch misalignment. Sweat ends are not acceptable.

### 2.04 JOINING MATERIALS

- A. Solder Filler Metal: ASTM B32, 95-5 Tin-Antimony 'lead-free' solder.
- B. Brazing Filler Metals: AWS A5.8, BCUP Series.
- C. Gasket Material: Thickness, material, and type suitable for fluid to be handled and design temperatures and pressure.

### 2.05 GENERAL DUTY VALVES

- A. General-duty valves (i.e., gate, globe, check, ball, and butterfly valves) are specified in Division 22 Section "Valves." Special duty valves are specified below by their generic name; refer to Part 3 Article "Valve Application" for specific uses and applications for each valve specified.

### 2.06 SPECIAL DUTY VALVES

- A. Balance Cocks: 400 PSI WOG, 2 piece, ball valve, handle, memory stop, with threaded-end connections conforming to ASME B1.20.1.
- B. Balance Cocks: 400 PSI WOG, 2 piece bronze, ball valve, handle, memory stop, with solder-end connections.

### 2.07 PIPING SPECIALTIES

- A. Water Hammer Arresters:
  - 1. J.R. Smith or Approved Equal.
  - 2. Bellows type, with stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201 shall be of the following sizes unless otherwise indicated on the drawings:

- a. Self-closing valves, lavatories, sinks, etc.

# WATER DISTRIBUTION PIPING (INSIDE BUILDING)

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Supply header or pipe size (Inch)	Manufacturer Name	Water Hammer Arrester Model No.
1/2"	J.R. Smith	5005
3/4"	J.R. Smith	5005
1"	J.R. Smith	5010

3. Flushometer, automatic and solenoid valves:  
a. J.R. Smith or Approved Equal.

Supply header or pipe size (Inch)	Manufacturer Name (a)	Water Hammer Arrester Model No.
3/4"	J.R. Smith	5010
1"	J.R. Smith	5010
1-1/4"	J.R. Smith	5030
1-1/2"	J.R. Smith	5040
2"	J.R. Smith	5050

- B. Y-Type Strainers: Provide strainers full line size of connecting piping, with ends matching piping system materials. Screens shall be Type 304 stainless steel, with 3/64" perforations at 233 per square inch. Strainers in copper lined to have bronze bodies.
- Provide strainers with 125 psi working pressure rating for low pressure applications, and 250 psi pressure rating for high pressure application.
  - Threaded ends, 2" and Smaller: Cast-iron body, or bronze body, screwed screen retainer with centered blow-down fitted with pipe plug.
  - Threaded Ends, 2-1/2" and Larger: Cast-iron body or bronze body bolted screen retainer with off-center blow-down fitted with pipe plug.
  - Flanged Ends, 2-1/2" and Larger: Cast-iron body or bronze body, bolted screen retainer with off-center blow-down fitted with pipe plug.
- C. Hose-Connections: Hose connections shall have garden hose threaded outlets conforming to ASME B1.20.7.
- D. Hose Bibs: Bronze body with chrome- or nickel-plated finish, with renewable composition disc, removable wheel handle, vacuum breaker, 3/4- inch solder inlet, hose outlet.
- E. Vacuum Breakers: Hose connection vacuum breakers shall conform to ASSE Standard 1011, with finish to match hose connection.
- F. Relief Valves: Sizes for relief valves shall be in accordance with ASME Boiler and Pressure Vessel Codes for indicated capacity of the appliance for which installed.
- Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Temperature relief valves shall be factory set at 210 degree F, and pressure relief at 150 psi.
- G. Escutcheons: Chrome-plated, stamped steel, hinged, split-ring escutcheon, with set screw. Inside diameter shall closely fit pipe outside diameter, or outside of pipe insulation.
- H. Sleeves:
- Sheet-Metal Sleeves: 10 gage, galvanized sheet metal, round tube closed with welded longitudinal joint.
  - Steel Sleeves: Schedule 40 galvanized, welded steel pipe, ASTM A53, Grade A.
- I. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

## PART 3 - EXECUTION

## WATER DISTRIBUTION PIPING (INSIDE BUILDING)

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### 3.01 EXAMINATION

- A. Examine rough-in requirements for plumbing fixtures and other equipment with water connections to verify actual locations of piping connections prior to installation.

### 3.02 PREPARATION

- A. Ream ends of pipes and tubes, and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris for both inside and outside of piping and fittings before assembly.

### 3.03 PIPE APPLICATIONS

- A. Install Type L, drawn copper tube with wrought copper fittings and solder joints for pipe sizes 4 inches and smaller, above ground, within building.
- B. Install Type K, annealed temper copper tube for pipe sizes 2 inches and smaller, with minimum number of joints, below ground.
- C. Water piping in sizes 2-1/2 to 6 inches may be Type L drawn copper tube with roll-grooved ends and mechanical couplings, above ground within building.

### 3.04 PIPING INSTALLATION

- A. General Locations and Arrangements; Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated.
- B. Use fittings for all changes in direction and branch connections.
- C. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted unless expressly indicated.
- D. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- E. Conceal all piping installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.
- F. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1-inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.
- G. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.
- H. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4-inch ball valve, and short 3/4-inch threaded nipple and cap.
- I. Pipe sleeves smaller than 6 inches shall be galvanized steel pipe; pipe sleeves 6 inches and larger shall be galvanized steel sheet metal.
- J. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls with sleeves and mechanical sleeve seals.
- K. Fire Barrier Penetrations: Where pipes pass through fire-rated walls, partitions, ceilings, and floors, maintain the fire-rated integrity. Refer to Division 07 for special sealers and materials.

### 3.05 HANGERS AND SUPPORTS

- A. General: Hanger, support, and anchor devices conforming to MSS SP-69 are specified in Division 22, Section "Supports and Anchors." Conform to the table below for maximum spacing of supports:

Support Type	Maximum Spacing (ft)
General	10
Fire Protection	5
Other	15
- B. Pipe Attachments: Install the following:

## WATER DISTRIBUTION PIPING (INSIDE BUILDING)

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1. Adjustable steel clevis hangers, MSS Type 1, for individual horizontal runs less than 20 feet in length.
  2. Adjustable roller hangers, MSS Type 43, and spring hangers, MSS Type 41 with Type 49, for individual horizontal runs 20 feet and longer.
  3. Pipe roll, complete MSS Type 44 for multiple horizontal runs, 20 feet or longer, support on a trapeze.
  4. Spring hangers to support vertical runs.
- C. Install hangers for horizontal piping with the following maximum spacing and minimum rod sizes:

Steel & Copper Nom. Pipe Size – In.	Steel Pipe Max. Span – Ft.	Steel Pipe Min. Rod	Copper Tube Max. Span – Ft.	Copper Tube Min. Rod
Up to 3/4	7	3/8	5	3/8
1	7	3/8	6	3/8
1-1/4	7	3/8	7	3/8
1-1/2	9	3/8	8	3/8
2	10	3/8	8	3/8
2-1/2	11	3/8	9	3/8
3	12	1/2	10	1/2
3-1/2	13	1/2	11	1/2
4	14	5/8	12	1/2
5	16	5/8	13	1/2
6	17	3/4	14	5/8
8	19	7/8	16	3/4
10	22	7/8	18	3/4
12	23	7/8	19	3/4

- D. Support vertical steel pipe and copper tube at each floor.

### 3.06 PIPE AND TUBE JOINT CONSTRUCTION

- A. Soldered Joints: Comply with the procedures contained in the AWS "Soldering Manual."
- B. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."
  1. CAUTION: Remove stems, seats, and packing of valves and accessible internal parts of piping specialties before soldering and brazing.
  2. Fill the tubing and fittings during soldering and brazing with an inert gas (nitrogen or carbon dioxide) to prevent formation of scale.
  3. Heat joints to proper and uniform temperature.
- C. Threaded Joints: Conform to ASME B1.20.1, tapered pipe threaded for field-cut threads. Join pipe fittings and valves as follows:
  1. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
  2. Align threads at point of assembly.
  3. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).
  4. Assembly joint wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.
    - a. Damaged Threads: Do not use pipe with corroded or damaged threads. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.
- D. Flanged Joints: Align flange surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.



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- E. Grooved-End Joints: Prepare pipe and tubing and install in accordance with manufacturer's installation instructions.

### 3.07 SERVICE ENTRANCE

- A. Extend water distribution piping to connect to water service piping, of size and in location indicated for service entrance to building. Water service piping is specified in separate section of Division 22.
- B. Install sleeve and mechanical sleeve seal at penetrations through foundation wall for watertight installation.

### 3.08 VALVE APPLICATIONS

- A. General-Duty Valve Applications: The Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shut-off duty: Use gate, ball, and butterfly valves.
  - 2. Throttling duty: Use globe and ball valves.

### 3.09 INSTALLATION OF VALVES

- A. Sectional Valves: Install sectional valves on each branch and riser, close to main, where branch or riser serves 2 or more plumbing fixtures or equipment connections, and elsewhere as indicated. For sectional valves 2 inches and smaller, use gate valves; for sectional valves 2-1/2 inches and larger, use gate or butterfly valves.
- B. Shutoff Valves: Install shutoff valves at inlet and outlet of each plumbing equipment item and elsewhere as indicated.
  - 1. At plumbing equipment: 2" and smaller use gate or ball valves.
  - 2. At plumbing equipment: 2-1/2" and larger use gate or butterfly valves.
  - 3. For plumbing fixtures see fixture trim.
  - 4. All other locations use gate valves.
- C. Drain Valves: Install drain valves on each plumbing equipment item, located to drain equipment completely for service or repair. Install drain valves at the base of each riser, at low points of horizontal runs, and elsewhere as required to drain distribution piping system completely. For drain valves use 3/4" hose end drain valve.
- D. Hose Bibs: Install on exposed piping where indicated. Provide vacuum breaker.

### 3.10 INSTALLATION OF PIPING SPECIALTIES

- A. Install backflow Preventers at each connection to mechanical equipment and systems and in compliance with the plumbing code and authority having jurisdiction. Install air cap fitting and pipe relief outlet drain without valves to nearest floor drain. Identify all piping downstream of backflow preventers as "industrial water".
- B. Install pressure-regulating valves with inlet and outlet shutoff valves and balance cock bypass. Install pressure gage on valve outlet.

### 3.11 INSTALLATION OF PIPING WATER HAMMER ARRESTORS

- A. Provide an air chamber at each valve water outlet or fixture supply for fixtures with manual closing valves. Air chamber shall be 18 inches long and one pipe size larger than supply to outlet. For a battery of fixtures, one air chamber 30 inches long and the full size of the header, but not less than 1 inch may be installed in lieu of individual air chambers. Precision Plumbing Products, JMJ "System Rated" arrestors are acceptable in lieu of air chambers.
- B. Install water hammer arrestors on supply line to fixtures with self-closing, automatic or Flushometer valves. Arrestors shall be as close as possible to individual fixtures and on the end of the header for a battery of fixtures. Arrestors shall be installed in the wall or furring, whenever possible, behind an access panel large enough to permit removal of the arrestor. Sizes as shown on the drawings or as specified hereinafter. Sizes and model numbers are J. R. Smith; equivalent arrestors by Josam, Wade or Zurn are acceptable.

## WATER DISTRIBUTION PIPING (INSIDE BUILDING)

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### 3.12 EQUIPMENT CONNECTIONS

- A. Piping Run-outs to Fixtures: Provide hot and cold water piping Run-outs to fixtures of sizes indicated, but in no case smaller than required by plumbing code.
- B. Equipment Connections: Connect hot and cold water piping system to equipment as indicated. Provide shutoff valve and union for each connection; provide drain valve on drain connection. For connections 2-1/2 inches and larger, use flanges instead of unions.

### 3.13 FIELD QUALITY CONTROL

- A. Inspections: Inspect water distribution piping as follows:
  - 1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.
  - 2. During the progress of the installation, notify the plumbing official having jurisdiction at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
    - a. Rough-In Inspection: After system is roughed in and prior to setting fixtures, arrange for inspection of the piping system before concealed or closed in.
    - b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to ensure compliance with the requirements of the plumbing code.
  - 3. Re-inspections: Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and arrange for re-inspection by the plumbing official.
  - 4. Reports: Prepare inspection reports signed by the plumbing official.
- B. Test water distribution piping as follows:
  - 1. Test for leaks and defects all new water distribution piping systems and parts of existing systems that have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
  - 2. Leave uncovered and unconcealed all new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose all such work for testing that has been covered or concealed before it has been tested and approved.
  - 3. Cap and subject the piping system to a static water pressure of 50 psig above the operating pressure without exceeding the pressure rating of the piping system materials. Isolate the test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - 4. Repair all leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.
  - 5. Prepare reports for all tests and required corrective action.

### 3.14 ADJUSTING AND CLEANING

- A. Clean and disinfect water distribution piping as follows:
  - 1. Purge all new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired prior to use.
  - 2. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction or, in case a method is not prescribed by that authority, the procedure described in either AWWA C651, or AWWA C652, or as described below:
    - a. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.
    - b. Fill the system or part thereof with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system or part thereof and allow to stand for 24 hours.
    - c. Drain the system or part thereof of the previous solution and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.

## WATER DISTRIBUTION PIPING (INSIDE BUILDING)

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- d. Following the allowed standing time, flush the system with clean, potable water until chlorine does not remain in the water coming from the system.
- e. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.

B. Prepare reports for all purging and disinfecting activities.

### **3.15 COMMISSIONING**

- A. Fill the system. Check compression tanks, where used, to determine that they are not air bound and that the system is completely full of water.
- B. Before operating the system, perform these steps:
  - 1. Close drain valve, hydrants, and hose bibs.
  - 2. Open valves to full open position.
  - 3. Remove and clean strainers.
  - 4. Check pumps for proper direction of rotation. Correct improper wiring.
  - 5. Lubricate pump motors and bearings.

**END OF SECTION**

**SECTION 22 11 19  
PIPING SPECIALTIES**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. This Section specifies piping specialties and installation methods common to more than one section of Division 22.

**1.02 RELATED SECTIONS**

- A. This section applies to all piping systems specified in Division 22.
- B. Valves are specified in a separate section and in individual piping system Sections of Division 22.
- C. Fire Barrier Penetration Seals are specified in Section 22 11 00.

**1.03 SUBMITTALS**

- A. Refer to Division 01 and Section 22 05 00 "Common Work Results for Plumbing" for administrative and procedural requirements for submittals.
- B. Product Data: Submit product data on the following items:
  - 1. Escutcheons
  - 2. Dielectric Unions and Fittings
  - 3. Mechanical Sleeve Seals
  - 4. Strainers

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. Manufacturer Uniformity: Conform to the requirements specified in Common Work Results For Plumbing, under "Product Options."
- B. Manufacturer: Subject to compliance with requirements, provide piping materials and specialties from one of the following:
  - 1. Pipe Escutcheons:
    - a. McGuire
    - b. BrassCraft
    - c. Pasco
  - 2. Dielectric Waterway Fittings:
    - a. Epco Sales, Inc.
    - b. Victaulic Company of America
  - 3. Dielectric Unions:
    - a. Eclipse, Inc.
    - b. Perfection Corp.
    - c. Watts Regulator Co.
  - 4. Strainers:
    - a. Armstrong Machine Works
    - b. Hoffman Specialty ITT; Fluid Handling Div.
    - c. Metraflex Co.
    - d. R-P&C Valve; Div. White Consolidated Industries, Inc.
    - e. SpiraxSarco
    - f. Trane Co.
    - g. Victaulic Co. of America. (low pressure applications only).
    - h. Watts Regulator Co.

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- 5. Mechanical Sleeve Seals:
  - a. Thunderline Corp.

**2.02 PIPE AND FITTINGS**

- A. Refer to the individual piping system specification sections in Division 22 for specifications on piping and fittings relative to that particular system.

**2.03 JOINING MATERIALS**

- A. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.
- B. Brazing Materials: Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials appropriate for the materials being joined.
- C. Soldering Materials: Refer to individual piping system specifications for solder appropriate for each respective system.
- D. Gaskets for Flanged Joints: Gasket material shall be full-faced for cast-iron flanges and raised-face for steel flanges. Select materials to suit the service of the piping system in which installed and which conform to their respective ANSI Standard (A21.11, B16.20, or B16.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

**2.04 PIPING SPECIALTIES**

- A. Escutcheons: Chrome-plated, stamped steel, hinged, split-ring escutcheon, with set screw. Inside diameter shall closely fit pipe outside diameter, or outside of pipe insulation where pipe is insulated. Outside diameter shall completely cover the opening in floors, walls, or ceilings.
- B. Unions: Malleable-iron, Class 150 for low pressure service and class 250 for high pressure service; hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends.
- C. Dielectric Unions: Provide dielectric unions with appropriate end connections for the pipe materials in which installed (screwed, soldered, or flanged), which effectively isolate dissimilar metals, prevent galvanic action, and stop corrosion.
- D. Dielectric Waterway Fittings: Electroplated steel or brass nipple, with an inert and non-corrosive, thermoplastic lining.
- E. Y-Type Strainers: Provide strainers full line size of connecting piping, with ends matching piping system materials. Screens shall be Type 304 stainless steel, with 3/64" perforations at 225 holes per square inch.
  - 1. Provide strainers with 125 psi working pressure rating for low-pressure applications, and 250 psi pressure rating for high-pressure application.
  - 2. Threaded Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.
  - 3. Threaded Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.
  - 4. Flanged Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blow-down fitted with pipe plug.
  - 5. Butt Welded Ends, 2-1/2" and Larger for Low Pressure Application: Schedule 40 cast carbon steel body, bolted screen retainer with off-center blowdown fitted with pipe plug.
  - 6. Butt Welded Ends, 2-1/2" and Larger for High Pressure Application: Schedule 80 cast carbon steel body, bolted screen retainer with off-center blowdown fitted with pipe plug.
  - 7. Grooved Ends, 2-1/2" and Larger: Tee pattern, ductile-iron or malleable-iron body and access end cap, access coupling with EDPM gasket.

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- F. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

**PART 3 - EXECUTION**

**3.01 ESCUTCHEONS**

- A. Install escutcheons at all exposed penetrations of piping through walls, ceilings, and floors in rooms with finish surfaces.

**3.02 FITTINGS AND SPECIALTIES**

- A. Install strainers on the supply side of each control valve, pressure reducing or regulating valve, solenoid valve, and elsewhere as indicated.
- B. Install unions adjacent to each valve and at the final connection to each piece of equipment and plumbing fixture having 2" and smaller connections, and elsewhere as indicated.
- C. Install Flanges in piping 2-1/2" and larger, where indicated, adjacent to each valve, and at the final connection to each piece of equipment.
- D. Install dielectric unions to connect piping materials of dissimilar metals in dry piping systems (gas, compressed air, vacuum).
- E. Install dielectric fittings to connect piping materials of dissimilar metals in wet piping systems (water, steam).

**END OF SECTION**

**SECTION 22 13 16**  
**SANITARY WASTE AND VENT PIPING**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. This Section includes building sanitary and storm drainage and vent piping systems, including drains and drainage specialties.

**1.02 RELATED SECTIONS**

- A. The following sections contain requirements that relate to this section:
  - 1. Division 22 Section "Plumbing Identification," for labeling and identification of drainage and vent piping.

**1.03 DEFINITIONS**

- A. Building Drain: That part of the lowest piping of a drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer.
- B. Building Sewer: That part of the piping within public or private premises which conveys sewage, rain water or other liquid wastes to a point of disposal.
- C. Drainage System: Includes all the piping within public or private premises which conveys sewage, rain water or other liquid wastes to a point of disposal. It does not include the mains of public sewer systems or a private or public sewage treatment or disposal plant.
- D. Vent System: A pipe or pipes installed to provide a flow of air to or from a drainage system, or to provide a circulation of air within such system to protect trap seals from siphonage and backpressure.

**1.04 SUBMITTALS**

- A. Product data for the following products:
  - 1. Drainage piping specialties

**1.05 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with the provisions of the following:
  - 1. California Plumbing Code (CPC): Current edition in use by authority having jurisdiction.

**1.06 SEQUENCING AND SCHEDULING**

- A. Coordinate the installation of roof drains, flashing, and roof penetrations.
- B. Coordinate flashing materials installation of roofing, waterproofing, and adjoining substrate work.
- C. Coordinate the installation of drains in poured-in-place concrete slabs, to include proper drain elevations, installation of flashing, and slope of slab to drains.
- D. Coordinate with installation of sanitary and storm sewer system as necessary to interface building drains with drainage piping system.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. Manufacturer: Subject to compliance with requirements, provide drainage and vent systems from one of the following:
  - 1. Drainage Piping Specialties, including backwater valves, expansion joints, drains, trap primers, and vandal-proof vent caps:
    - a. J. R. Smith Mfg. Co.
    - b. Josam Mfg. Co.
    - c. Zurn Industries Inc; Hydromechanics Div.
    - d. Tyler Pipe; Subs. of Tyler Corp.

**2.02 ABOVE GROUND DRAINAGE AND VENT PIPE AND FITTINGS**

## SANITARY WASTE AND VENT PIPING

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- A. General: Select from the following options:
  - 1. Pipe Sizes Larger than 2": Cast-iron soil pipe. Conform to ASTM A74, for service weight, hub-and-spigot soil pipe and fittings, with clamps and compression gasket joints conforming to ASTM C564. Piping shall bear the CISPI stamp.
  - 2. Pipe Sizes Larger than 2": Hub-less cast-iron soil pipe. Conform to CISPI Standard 301, Service weight, cast-iron soil pipe and fittings, with neoprene gaskets conforming to CISPI Standard 310. Piping shall bear the CISPI stamp.

### 2.03 UNDERGROUND BUILDING DRAIN PIPE AND FITTINGS

- A. Pipe and fittings shall have heavy coating of coal tar varnish or 'asphaltum' on both inside and outside surfaces.
- B. General: For pipe and fittings below grade and/or below finish floor of floors on grade select from the following options:
  - 1. Pipe Sizes 15" and Smaller: Cast-iron soil pipe. Conform to ASTM A74, for standard weight hub and spigot soil pipe and fittings, with clamps and neoprene gasket, conforming to ASTM C564. Piping shall bear the CISPI stamp.
  - 2. Pipe Sizes 16" and Smaller: Hub-less cast iron soil pipe, conform to CISPI Standard 301, service weight; with "Best" or "MG" cast iron joint connection couplings. Coupling body shall conform to ASTM A-48 or ASTM A-74 with neoprene gasket conforming to ASTM C-564. Piping shall bear the CISPI stamp.

### 2.04 DRAINAGE PIPE SPECIALTIES

- A. Trap Primers: Bronze body valve with automatic vacuum breaker, with 1/2 inch connections matching piping system. Complying with ASSE 1018.
- B. Expansion Joints: Cast-iron body with adjustable bronze sleeve, bronze bolts with wing nuts.
- C. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.

### 2.05 CLEANOUTS

- A. Cleanouts on cast iron soil pipe, iron body with ABS plugs screwed into caulking ferrules. Cleanouts on steel pipe, ABS plugs. Cleanouts on vitrified clay pipe, vitrified clay pipe. Where cleanouts occur in finished interior surfaces, smooth polished chromium plated. Exposed parts of floor cleanouts in finished rooms, non-slip polished nickel bronze. Floor cleanouts adjustable type. Where cleanouts occur in carpeted floor areas, the cover shall be elevated so as to be flush with finished carpeted areas.
- B. Floor Cleanouts: Cast-iron body and frame, with cleanout plug and adjustable round top as follows:
  - 1. Floor level type in rooms with concrete floor: Smith #4021, Josam 58330-2, or Zurn Z1420-25 with cast iron top.
- C. Wall Cleanouts: Cast-iron body adaptable to pipe with ABS plastic plug; stainless steel cover including screws.
  - 1. Wall type for cast-iron pipes: Smith #4532, Josam 58790-4, or Zurn Z-1445-1.
  - 2. Wall type for steel pipes: Smith #4472, Josam 58890-4, or Zurn 1460-8.
- D. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide under-deck clamp and sleeve length as required.
- E. Vent Flashing Sleeves: Cast-iron caulking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks.
- F. Vandal-Proof Vent Caps: Cast-iron body full size of vent pipe, with caulked base connection for cast-iron pipes, threaded base for steel pipes.

### 2.06 FLOOR DRAINS

- A. Floor drains are specified in Section 22 42 00 "Commercial Plumbing Fixtures."

## PART 3 - EXECUTION



## SANITARY WASTE AND VENT PIPING

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### 3.01 EXAMINATION

- A. Verify all dimensions by field dimensions. Verify that all drainage and vent piping and specialties may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Verify existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.
- C. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.
- D. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.
- E. Do not proceed until unsatisfactory conditions have been corrected.

### 3.02 PREPARATION FOUNDATION FOR UNDERGROUND BUILDING DRAINS

- A. Grade trench bottoms to provide a smooth, firm, and stable foundation, free from rock, throughout the length of the pipe.
- B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated invert elevation.
- C. Shape bottom of trench to fit bottom of pipe for 90-degrees (bottom 1/4 of the circumference). Fill unevenness with tamped sand backfill. At each pipe joint dig bell holes to relieve the bell of the pipe of all loads, and to ensure continuous bearing of the pipe barrel on the foundation.

### 3.03 PIPE APPLICATIONS - ABOVE GROUND, WITHIN BUILDING

- A. General: Select from following options:
  - 1. Install hub-and spigot, service weight, cast-iron soil pipe with compression gasket joints for larger than 2 inches drainage and vent pipe. Piping shall bear the CISPI stamp.
  - 2. Install Hub-less, service weight, cast-iron soil pipe and fittings for larger than 2 inch drainage and vent pipe. Piping shall bear the CISPI stamp.

### 3.04 PIPE APPLICATIONS - BELOW GROUND, WITHIN BUILDING

- A. General: Select from the following options:
  - 1. Install hub-and-spigot, heavy service weight, cast-iron, soil pipe and fittings with gasket joints for 15 inch and smaller drainage pipe. Piping shall bear the CISPI stamp.
  - 2. Install hub-less, service weight, cast-iron soil pipe with Anaco Husky SD 4000 stainless steel couplings with neoprene gaskets. Piping shall bear the CISPI stamp.

### 3.05 PIPE AND TUBE JOINT CONSTRUCTION

- A. Copper Tubing: Solder joints in accordance with the procedures specified in AWS "Soldering Manual."
- B. Cast-Iron Soil Pipe: Make lead and oakum caulked joints, compression joints, and hub-less joints in accordance with the recommendations in the CISPI Cast Iron Soil Pipe and Fittings Handbook, Chapter IV.
- C. Install couplings per manufacturer's recommendations.

### 3.06 INSTALLATION

- A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into account many design considerations. So far as practical, install piping as indicated.
- B. Use fittings for all changes in direction and all branch connections.
- C. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

## SANITARY WASTE AND VENT PIPING

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- D. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- E. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.
- F. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Allow sufficient space above removable ceiling panels to allow for panel removal.
- G. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel; pipe sleeves 6 inches and larger shall be sheet metal.
- H. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings and floors, maintain the fire rated integrity.
- I. Make changes in direction for drainage and vent piping using appropriate 45 degree wyes, half-wye, or long sweep quarter, sixth, eighth, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.
- J. Install underground building drains to conform with the plumbing code, and in accordance with the Cast Iron Soil Pipe Institute Engineering Manual. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.
- K. Install building drain pitched down at minimum slope of 1/4 inch per foot (2 percent) for piping 3 inch and smaller, and 1/8 inch per foot (1 percent) for piping 4 inch and larger.
- L. Extend building drain to connect to sewer piping, of size and in location indicated for service entrance to building. Sewer piping is specified in a separate section of Division 22.
- M. Install sleeve and mechanical sleeve through foundation wall for watertight installation.

### 3.07 HANGERS AND SUPPORTS

- A. General: Hangers, supports, and anchorage devices are specified in Division 22 Section "Plumbing Piping." Conform to the table below for maximum spacing of supports:
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.
- C. Install hangers at the following intervals:

Pipe material	Max. Horizontal Spacing (Ft.)	Max. Vertical Spacing (Ft.)
Cast Iron Pipe	5	15
Copper Tubing 1-1/2" & Smaller	6	10
Copper Tubing 2" & Larger	10	10

## SANITARY WASTE AND VENT PIPING

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### 3.08 INSTALLATION OF PIPE SPECIALTIES

- A. Install backwater valves in sanitary building drain piping as indicated, and as required by the plumbing code. For interior installation, provide cleanout cover flush to floor centered over backwater valve cover and of adequate size to remove valve cover for service.
- B. Install expansion joints on vertical risers as indicated, and as required by the plumbing code.
- C. Above Ground Cleanouts: Install in above ground piping and building drain piping as indicated, and:
  - 1. As required by plumbing code.
  - 2. At each horizontal change in direction of piping greater than 135 degrees.
  - 3. At maximum intervals of 50' for piping 3" and smaller and 100' for larger piping.
  - 4. At base of each vertical soil or waste stack.
- D. Cleanouts Covers: Install floor and wall cleanout covers for concealed piping.
- E. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

### 3.09 INSTALLATION OF TRAP PRIMERS

- A. Install trap primers with piping pitched towards drain trap, minimum of 1/8 inch per foot (1 percent). Adjust trap primer for proper flow. Provide trap primer for all floor drains and floor sinks. Multiple outlet primers are acceptable.

### 3.10 CONNECTIONS

- A. Piping Run-outs to Fixtures: Provide drainage and vent piping run-outs to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the plumbing code.

### 3.11 FIELD QUALITY CONTROL

- A. Inspections:
  - 1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.
  - 2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
    - a. Rough-In Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
    - b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.
  - 3. Re-inspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for re-inspection by the plumbing official.
  - 4. Reports: Prepare inspection reports, signed by the plumbing official.
- B. Piping System Test: Test drainage and vent system in accordance with the procedures of the authority having jurisdiction, or in the absence of a published procedure, as follows:
  - 1. Test for leaks and defects all new drainage and vent piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
  - 2. Leave uncovered and unconcealed all new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose all such work for testing, which has been covered or concealed before it has been tested and approved.
  - 3. Rough Plumbing Test Procedure: Except for outside leaders and perforated or open jointed drain tile, test the piping of plumbing drainage and venting systems upon completion of the rough piping installation.

## SANITARY WASTE AND VENT PIPING

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Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.

4. Finished Plumbing Test Procedure: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure of 1" water column. Use a "U" tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.
5. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
6. Prepare reports for all tests and required corrective action.

### **3.12 ADJUSTING AND CLEANING**

- A. Clean interior of piping system. Remove dirt and debris as work progresses.
- B. Clean drain strainers, domes, and traps. Remove dirt and debris.

### **3.13 PROTECTION**

- A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

**END OF SECTION**

**SECTION 22 42 00**  
**COMMERCIAL PLUMBING FIXTURES**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. This section specifies plumbing fixtures and trim. The types of fixtures specified include the following:
  - 1. Water Closets
  - 2. Urinals
  - 3. Lavatories (including wheelchair type)
  - 4. Service Sinks
  - 5. Mop Basins
  - 6. Electric Water Coolers (including wheelchair type)
  - 7. Faucets
  - 8. Flush Valves
  - 9. Fixture Supports (including wheelchair type)
  - 10. Toilet Seats
  - 11. Fittings, Trim, and Accessories
  - 12. Floor Drains
  - 13. Roof Drains

**1.02 RELATED SECTIONS**

- A. Separate grab bars and toilet accessories not in integral part of plumbing fixtures and are specified in Division 10.
- B. Electrical Requirements for, Water Heaters, water conditioners, and other plumbing equipment are specified in other Sections of Division 22 and Division 26.

**1.03 SUBMITTALS**

- A. Product Data: Submit Product Data and installation instructions for each fixture, faucet, specialties, accessories, and trim specified; clearly indicate rated capacities of selected models of water coolers, and water heaters.
- B. Shop Drawings: Submit rough-in drawings. Detail dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages. Coordinate requirements with Architectural Woodwork shop drawings specified in Division 06 for fixtures installed in countertops and cabinets. Furnish templates for use in woodwork shop.
- C. Wiring Diagrams: Submit manufacturer's electrical requirements and wiring diagrams for power supply to units. Clearly differentiate between portions of wiring that are factory installed and field installed portions.
- D. Maintenance Data: Include data in Maintenance Manual specified in Division 01 and Section 22 05 00.
- E. Quality Control Submittals:
  - 1. Submit certification of compliance with specified ANSI, UL, and ASHRAE Standards.
  - 2. Submit certification of compliance with performance verification requirements specified in this Section.

**1.04 QUALITY ASSURANCE**

- A. Codes and Standards:
  - 1. California Building Code 2019, Title 24, Part 2 for Accessibility Requirements.
    - a. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Section 11B-213.3.
    - b. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 06.

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- c. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
- d. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for children's water closets, 11B-605.4 for urinals, 11B-606.4 for lavatories and sinks, 11B-604.9.5 for bathtubs, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.
- e. Accessible lavatories and sinks shall be mounted with the front of the higher of the rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with CBC Section 11B-306 when a forward approach is required. CBC Sections 11B-606.3 and 11B-606.7.
- f. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Sections 11B-606.5
- g. Clearance around accessible water closets and in toilet compartments shall be 60 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the rear wall per CBC Section 11B-604.3.1.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Store fixtures where environmental conditions are uniformly maintained within the manufacturer's recommended temperatures to prevent damage.
- B. Store fixtures and trim in the manufacturer's original shipping containers. Do not stack containers or store in such a manner that may cause damage to the fixture or trim.
- C. Clearance around accessible water closets and in toilet compartments shall be 60 inches minimum measured perpendicular from the side wall and 56 inches minimum measured perpendicular from the rear wall per CBC Section 11B-604.3.1.

**1.06 SEQUENCE AND SCHEDULING**

- A. Schedule rough-in installations with the installation of other building components.

**1.07 MAINTENANCE**

- A. Extra Stock: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt in a quantity of one device for each 10 fixtures.
- B. Repair Kits: Furnish faucet repair kits complete with all necessary washers, springs, pins, retainer packings, O-rings, sleeves, and seats in a quantity of 1 kit for each 40 faucets.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. Manufacturer uniformity shall be as specified in Section 22 05 00: "Common Work Results for Plumbing."
- B. The following specification mentions manufacturers to establish a standard quality. The following fixtures and accessories are acceptable, if used throughout:
  - 1. Water Closets, Urinals, Lavatories, Service Sinks:
    - a. American Standard
    - b. Kohler Co.
  - 2. Stainless Steel Sinks:
    - a. Elkay Mfg. Co.
    - b. Just Mfg. Co.
  - 3. Faucets:
    - a. Chicago Faucet Co.
    - b. T & S Brass
    - c. Speakman

COMMERCIAL PLUMBING FIXTURES  
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4. Flush Valves:
  - a. Sloan Valve Co.
5. Water Closet Seats:
  - a. Church Products
  - b. Bemis
  - c. Beneke Corp
6. Fixture Supports:
  - a. Jay R. Smith Manufacturing Co.
  - b. Josam Mfg. Co.
  - c. Zurn Industries, Inc.; Hydromechanics Div.
7. Drains:
  - a. Jay R. Smith Manufacturing Co.
  - b. Josam Mfg. Co.
  - c. Zurn Industries, Inc.; Hydromechanics Div.

**2.02 FIXTURES**

- A. Plumbing fixture trim and exposed supplies and wastes are to be brass with polished chromium plated finish unless otherwise specified. Provide individual lose key or screwdriver stops for all fixture supplies. Separately trap all wastes. Furnish chrome plated wall escutcheons for all exposed supplies and trap arms. Locate stops below fixtures or countertops. All accessible sink and lavatory fixtures shall have exposed water pipes and tailpiece and trap covered with insulated fitting covers.
- B. All plumbing fixture faucets submitted for review shall have identification label or certification showing compliance with California Title 24, Part 5, Article 1, "Energy Conservation Standards"; Article 1, T20-1406; Article 2, T20-1525 and Article 4, 1604, and 1606.
- C. Provide fixtures as scheduled on plumbing drawings and requirements of this Section.

**2.03 SINK FAUCET**

- A. Description: General Service faucet. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
  1. Maximum Flow Rate: 1.5 GPM.
  2. Where a metering faucet is specified at an accessible sink, adjust run time for a minimum of 10 seconds for ADA compliance.

**2.04 LAVATORY FAUCET**

- A. Description: General Service faucet. Include hot- and cold-water indicators as occurs; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
  1. Maximum Flow Rate: 0.35 GPM.
  2. Where a metering faucet is specified at an accessible lavatory, adjust run time for a minimum of 10 seconds for ADA compliance.

**2.05 FLUSHOMETER**

- A. Description: Flushometer for urinal and water-closet]-type fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
  1. Consumption for Urinal: 0.5 gal./flush.
  2. Consumption for Water closet: 1.28 gal./flush.

**2.06 WATER CLOSET**

- A. Description Accessible Wall-mounting, back-outlet, top-spud, vitreous-china fixture designed for flushometer valve operation.
  1. Style: Flushometer valve.
    - a. Design Consumption: 1.28 gal./flush.
- B. Description: Accessible Floor-mounting, floor-outlet, top-spud, vitreous-china fixture designed for flushometer valve operation.

COMMERCIAL PLUMBING FIXTURES  
22 42 00 - 4

1. Style: Flushometer valve.
  - a. Design Consumption: 1.28 gal./flush.

**2.07 URINAL**

- A. Description: Accessible, Wall-mounting, back-outlet, top-spud, vitreous china fixture designed for flushometer valve operation.
  1. Design Consumption: 0.125 gal./flush.

**2.08 FIXTURE SUPPORTS**

- A. Lavatory Supports: Adjustable cast iron, with thin concealed arms and sleeves, and complete with escutcheons and mounting fasteners.
- B. Water Closet Supports: Adjustable, factory painted, cast iron face plate, support base, and appropriate type waste fitting having face plate gasket; zinc plated steel fixture studs and fasteners; coated and threaded adjustable wall coupling with neoprene closet outlet gasket; and chrome plated fixture cap nuts and fiber fixture washers. Provide an appropriate model to suit deep or shallow rough-in, siphon jet or blow-out water closet, and type of sanitary piping system to which it is connected.
- C. Wheelchair Water Closet Supports: Adjustable, factory painted, cast iron face plate, support base, and appropriate type waste fitting having face plate gasket; zinc plated steel fixture studs and fasteners; coated and threaded adjustable wall coupling with neoprene closet outlet gasket; and chrome plated fixture cap nuts and fiber fixture washers. Units shall have elevated mounting heights of wheelchair fixtures, siphon jet or blow-out water closet, and type of sanitary piping system to which it is connected.

**2.09 ESCUTCHEONS**

- A. Select one of the two options below:
  1. Chrome-plated cast brass with set screw.
  2. Chrome-plated sheet steel with friction clips.

**PART 3 - EXECUTION**

**3.01 EXAMINATION**

- A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.
- C. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- D. Do not proceed until unsatisfactory conditions have been corrected.

**3.02 INSTALLATION OF FIXTURES**

- A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards.
- B. Comply with the installation requirements of the 2019 California Building Code "CBC" Division 6 for accessible plumbing fixtures. Reference Article 1.04, A., 1., a. thru f. of this Section.
- C. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.
- D. Securely attach wall hung fixtures to a 3/8 inch x 6 inch wide steel plate. Steel plate to extend at least one stud beyond first and last mounting point. Drill and tap plate at time of installation of fixture or fixture hanger. Support fixture hanger with 1/2" diameter threaded studs, jamb nuts, C.P. Acorn nuts and completely free of wall by means of a second set of jamb nuts. Weld plate to each metal stud crossed by means of a continuous vertical fillet weld and same size as stud thickness.



COMMERCIAL PLUMBING FIXTURES  
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Secure plate to each wood stud crossed by securely bolting to each stud crossed with two 1/2-inch steel bolts, 4-inch center with 1/8-inch maximum x 1-1/2 inch steel back up plates. Notch studs to set plate flush with surface.

- E. Set mop basins in a leveling bed of cement grout.
- F. Install a stop valve in an accessible location in the water connection to each fixture.
- G. Install chrome plated brass escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and with cabinets and millwork.
- H. Seal fixtures to walls and floors using silicone sealant as specified in Section 07 90 00. Match sealant color to fixture color.
- I. Provide abrasive washers under all single drilling deck mounted trim.

**3.03 INSTALLATION OF FLOOR DRAINS**

- A. Install floor drains in accordance with manufacturer's written instructions and in locations indicated.
- B. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.
- C. Set drain elevation depressed below finished slab elevation as listed below to provide proper slope to drain:

Depression (Inch)	Radius Of Area Drained (Feet)
1/2	5
3/4	10
1	15
1-1/4	20
1-1/2	25

- D. Trap all drains connected to the sanitary sewer.
- E. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.
- F. Position drains so that they are accessible and easy to maintain.

**3.04 INSTALLATION OF TRAP PRIMERS**

- A. Install trap primers with piping pitched towards drain trap, minimum of 1/8 inch per foot (1 percent). Adjust trap primer for proper flow.

**3.05 INSTALLATION OF ROOF DRAINS**

- A. Install roof drains at low points of roof areas, in accordance with the roof membrane manufacturer's installation instructions.
- B. Install drain flashing collar or flange so that no leakage occurs between roof drain and adjoining roofing. Maintain integrity of waterproof membranes, where penetrated.
- C. Position roof drains so that they are accessible and easy to maintain.

**3.06 FIELD QUALITY CONTROL**

- A. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.
- B. Inspect each installed unit for damage. Replace damaged fixtures.

**3.07 ADJUSTING**

- A. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow and stream.
- B. Replace washers or leaking or dripping faucets and stops.

COMMERCIAL PLUMBING FIXTURES  
22 42 00 - 6

- C. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

**3.08 CLEANING**

- A. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

**3.09 PROTECTION**

- A. Provide protective covering for installed fixtures, water coolers, and trim.  
B. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by Owner.

**3.10 MOUNTING HEIGHTS SCHEDULE**

Fixture	Mounting Height
Water Closet	See Architectural Drawings
Accessible Water Closet	See Architectural Drawings
Urinal	See Architectural Drawings
Accessible Urinal	See Architectural Drawings
Lavatory or Sink	See Architectural Drawings
Accessible Lavatory / Sink	See Architectural Drawings
Accessible Water Cooler	See Architectural Drawings

**3.11 ROUGH-IN FOR FIXTURES**

- A. Rough-in for all fixtures and/or equipment as shown on any drawings, including the architectural drawings, which forms a part of the contract documents. This shall include all fixtures and equipment shown and/or noted as N.I.C. (not in contract) or as U.O.S. (furnished under another section of the specification). Stub out all piping to the exact location of the fixtures and set symmetrical with the fixture. Stub out for fixture supply pipes with drop ear fittings secured to stud or backing plate. Stub out two pipe diameter and terminate with pipe cap. When liens are indicated as capped or plugged at floor level, plug flush with the finished floor.

**END OF SECTION**

**SECTION 23 05 00**  
**COMMON WORK RESULTS FOR HVAC**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Project specification Sections, apply to this and the other sections of Division 23.
- B. This Division is an integrated whole comprising interrelated and interdependent Section and shall be considered in its entirety in determining requirements of the Work.
- C. Refer to other sections of this Division for additional requirements or information regarding the subjects of this Section.

**1.02 SECTION INCLUDES**

- A. This Section includes general administrative and procedural requirements for HVAC installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01:
  - 1. Submittals.
  - 2. Coordination drawings.
  - 3. Record documents.
  - 4. Maintenance manuals.
  - 5. Rough-ins.
  - 6. Mechanical installations.
  - 7. Cutting and patching.

**1.03 SUBMITTALS**

- A. General: Follow the procedures specified in Division 01.
- B. HVAC submittals shall include shop drawings, product data, and samples per requirements of each section of specification
- C. HVAC Submittals and Product Data: Assemble "submittals" and "product data" into tabbed brochures according to main areas of work i.e. (HVAC); Temperature Control; Testing, Adjusting, and Balancing.
  - 1. Assemble each brochure with tabbed separators for each Specification Section where products are noted to be submitted, with separate tabs for each product listed.
  - 2. Temperature "control shop drawings" may be submitted separately after preparations for review.
  - 3. For items such as valves, hangers and accessories, indicate specific items and where they are to be used.
  - 4. Contractor need only to submit for review those items specified to be submitted, unless requested by the Architect for special review.
- D. All submittals shall be submitted in hard copy, electronic submittals are not acceptable.
- E. Increase the number of HVAC related submittals including; shop drawings, product data, and samples submitted to allow for required distribution by one additional copy, which will be retained by the Mechanical Consulting Engineer.
- F. Submit for review, only the specific items required in this Section or other Sections of Division 23.
- G. Additional submittals shall include, but not limited:
  - 1. Air balance reports and equipment data record drawings.
  - 2. Certification of completion of testing.
  - 3. Certification of completion of operation instructions.
  - 4. Operating instruction brochure.
  - 5. Maintenance instruction brochures.
  - 6. Equipment guarantees.

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7. 1/4" = 1'-0" or larger scale layouts of "Equivalent" equipment or "Or Approved Equal" equipment.
  8. Coordination Drawings, where requested or required.
- H. Submittal materials will be reviewed for substantial conformity with the intent of the contract plans and specifications only. Such review does not indicate approval of dimensions, quantities, coordination with other trades, or work methods of the contractor, which are indicated thereon.
- I. Additional copies may be required by individual sections of these specifications.

**1.04 COORDINATION**

- A. The Contractor shall be totally responsible for coordinating the layout of all building elements to avoid conflict of the work of the structural, mechanical, electrical systems, and architectural features of the building.
- B. The cost of any extra work of any kind caused by a conflict due to this lack of coordination shall be borne by the Contractor.

**1.05 COORDINATION OF DRAWINGS**

- A. Prepare coordination drawings in accordance with requirements of Project Specification to a scale of 1/4" = 1'-0" or larger; detailing major elements, components, required clearances, and systems of HVAC equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of the installations are of importance to the efficient flow of the Work, including but not necessarily limited to the following:
1. Indicate the proposed locations of piping, ductwork, equipment, and materials. Include the following:
    - a. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
    - b. Equipment for connections and support details.
  2. Prepare reflected ceiling plans to coordinate and integrate installations with other systems and components, such as, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.
- B. Submittal of "Or Equal" substitutions of equipment will not be reviewed unless accompanied by coordination drawings.

**1.06 RECORD DOCUMENTS**

- A. Prepare record documents in accordance with the requirements of project specification. In addition to the requirements of project specification, indicate the following installed conditions:
1. Record drawings of all installed as specified in Division 01 the locations and invert elevations of underground installations.

**1.07 MAINTENANCE MANUALS**

- A. Prepare maintenance manuals in accordance with Project specification and Division 23 Section "Supplementary Mechanical Requirements."

**1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, mill certification, and other information needed for identification.

**1.09 EQUIVALENT EQUIPMENT**

- A. In these specification and drawings, whenever more than one (1) manufacturer's product is specified, the manufacturer specified on the drawings and the first named product in these specifications is the basis of design and the use of alternate-named manufacturer's product or substitutes may require modification in the design work and agency approvals. If such alternatives or substitutions are proposed by the contractor, contractor shall adhere to the following requirements;

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1. Contractor shall clearly identify all proposed alternatives or substitutions in the submittal package.
  2. The Contractor shall assume all costs required to make all necessary revisions and modifications of the contract documents resulting from the substitution or selection of an alternate manufacturer's product, including all professional fees and the cost of DSA approval.
  3. The Contractor shall assume all costs required for any additional modification to building structure, electrical and all other related construction costs resulting from the substitution or selection of an alternate manufacturer's product
- B. These specifications and/or drawings, names and specifies certain equipment in detail which are the basis of design and are explained in paragraph 1.09, A. above. It also names alternate equipment by manufacturer, which is not considered to be a "substitution".
- C. Submit equivalent equipment to the Architect for review per the requirements of Division 01, and Section "Common Work Results for HVAC."
- D. Equipment of Manufacturers named in Division 23 will be considered equivalent to that specified in detail and/or named on the drawings if:
1. The proposed equipment is of equivalent quality, capacity.
  2. Equipment is as fully equipped, fits the space allotted, and has physical configuration and weight similar to the equipment specified in detail.
- E. A complete lay out of an equipment room or area must be submitted for equivalent equipment. Notice space limitations. Layouts to include plans and section views at a scale of not less than 1/4" = 1 ft.
- F. The Architect shall determine the acceptability of "Equivalent Equipment."

**PART 2 - PRODUCTS** (Not Applicable)

**PART 3 - EXECUTION**

**3.01 ROUGH-IN**

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

**3.02 MECHANICAL INSTALLATIONS**

- A. General: Sequence, coordinate, and integrate the various elements of HVAC systems, materials, and equipment. Comply with the following requirements:
1. Coordinate HVAC systems, equipment, and materials installation with other building components.
  2. Verify all dimensions by field measurements.
  3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for HVAC installations.
  4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
  5. Sequence, coordinate, and integrate installations of HVAC materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
  6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible as required by California Building Code.
  7. Coordinate connection of HVAC system with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
  8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect prior to commencement of installation.

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9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.
10. Install all HVAC equipment to facilitate servicing, maintenance, and repair or replacement of equipment components in full compliance with California Building Code and the equipment manufacturer's recommendations. If the drawings or the manufacturer does not provide a specific space requirement for servicing equipment, provide as a minimum, horizontal distance of 36" from face of equipment to opposite vertical surface.
11. Install access panels or doors for all equipment and components which require access for adjustment and maintenance, where units are concealed behind finished surfaces.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Any equipment located above a ceiling that has any component, which is serviceable shall be installed within 12" of the top of the ceiling.

**3.03 CUTTING AND PATCHING**

- A. General: Perform cutting and patching in accordance with project specification. In addition to the requirements specified in project specification, the following requirements apply:
  1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- B. Perform cutting, fitting, and patching of HVAC equipment and materials required to:
  1. Uncover Work to provide for installation of ill-timed Work.
  2. Remove and replace defective work.
  3. Remove and replace Work not conforming to requirements of the Contract Documents.
  4. Remove samples of installed Work as specified for testing.
  5. Install equipment and materials in existing structures.
  6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
- C. Cut, remove and legally dispose of selected HVAC equipment, components, and materials as indicated, including but not limited to removal of HVAC piping, refrigerant lines, heating units, and other HVAC items made obsolete by the new Work.
- D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed
- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
  1. Patch existing finished surfaces and building components using experienced installers and new materials matching existing materials. For installer's qualifications refer to the materials and methods required for the surface and building components being patched.

**END OF SECTION**

**SECTION 23 05 11**  
**SUPPLEMENTARY HVAC REQUIREMENTS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. This Section specifies supplementary requirements for HVAC installations and includes requirements common to more than one section of Division 23. It expands and supplements the requirements specified in Section 230500 "Common Work Results for HVAC."

**1.02 DESCRIPTION**

- A. Provide a complete and operable installation, including all labor, supervision, materials, equipment, tools, apparatus, transportation, warehousing, rigging, scaffolding and other equipment and services necessary to accomplish the work in accordance with the intent and meaning of these drawings and specifications.

**1.03 COORDINATION**

- A. Coordination of the work is the responsibility of the Contractor.
- B. Contractor shall designate an individual competent and versed in the HVAC trades to coordinate the HVAC work with the work of other trades.

**1.04 DEFINITIONS (AS USED ON DIVISION 23 DRAWINGS AND HEREIN)**

- A. "Provide" means furnish, install and connect unless otherwise described in specific instances.
- B. "Piping" means pipes, fittings, valves and all like pipe accessories connected thereto.
- C. "Ductwork" means ducts, plenums, compartments, or casings including the building structure, which are used to convey or contain air.
- D. "Extend", "Submit", "Repair" and similar words mean that the Contractor (or his designated subcontractor) shall accomplish the action described.
- E. "Codes" or "Code" means all codes, laws, statutes, rules, regulations, ordinances, orders, decrees, and other requirements of all legally constituted authorities and public utility franchise holders having jurisdiction.
- F. "Products", "Materials" and "Equipment" are used interchangeably and mean materials, fixtures, equipment, accessories, etc.
- G. "Utility Areas" are defined as mechanical, electrical, janitorial, and similar rooms or spaces which are normally used or occupied only by custodial or maintenance personnel. "Public Areas" are defined as the rooms or spaces, which are not included in the utility areas definition.
- H. "Building Boundary" includes concrete walkways immediately adjacent to the building structure.
- I. "Below Grade" means buried in the ground.
- J. "Substantial Completion" means all components of all systems are functioning but lacking in final adjustment.
- K. Pressure rating specified (such as for valves and the like) means design working pressure for and with references to the fluid, which the device will serve.

**1.05 RELATED WORK**

- A. Coordination: Refer to Architectural, HVAC, Plumbing, Civil, Structural, and Electrical Drawings for the construction details and coordinate the work of this Division with that of other Divisions. Order the work of this Division so that progress will harmonize with that of other Divisions and all work will proceed expeditiously. The work of this Division shall include direct responsibility for the correct placing and connection of HVAC work in relation to the work of other Divisions.
- B. Examine other Divisions for work related to the Work of this Division, especially Divisions 22 & 26.

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**1.06 EXISTING CONDITIONS**

- A. Visit the site prior to bidding and investigate the existing conditions, which affect or will be affected by the work of this Division. Become thoroughly familiar with the working conditions and take into account any special or unusual features peculiar to this job. By the act of submitting a Bid, the Contractor will be deemed to have complied with the foregoing, to have accepted such conditions, and to have made allowance therefore in preparing his Bid.
- B. The locations of existing concealed utility lines are shown in accordance with reference data received by the Architect. The Architect does not guarantee the accuracy of such data. The points of connection are therefore approximate and the Bidder shall include adequate funds in his Bid to cover costs of connection regardless of their exact location.
- C. Exercise extreme caution during trenching operations. Repair the damage caused by such operations to existing utility lines at no cost to the Owner, whether the lines are shown on drawings or not.

**1.07 DRAWINGS AND SPECIFICATIONS**

- A. These drawings and specification do not include necessary components for construction safety.
- B. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".
- C. Except where dimensioned, the drawings relating to this division are a diagrammatic presentation of the design concept, which indicates the general area where piping and ductwork is to be run. The drawings do not necessarily indicate any and all offsets and configurations required for coordination with other trades. The contractor is responsible for the correct placing of his work, and the proper location and connection of his work in relation to the work or other trades.

**1.08 PERMITS AND INSPECTIONS**

- A. Obtain, schedule and pay for permits, licenses, approvals, tests, and inspections required by legally constituted authorities and public utility franchise holders having jurisdiction over the work.
- B. Afford the Architect's representative every facility for evaluating the skill and competence of the mechanics and to examine the materials. Concealed work shall be reopened when so directed during his periodic visits.

**1.09 CODES AND REGULATIONS**

- A. By submitting a Bid, Contractor is deemed to represent himself as competent to accomplish the work of this Division in conformance with applicable Codes. In case of conflict between the Contract Documents and Code requirements, the Codes shall take precedence. Should such conflicts appear, cease work on the parts of the contract affected and immediately notify the Architect in writing. It shall be the Contractor's responsibility to correct, at no cost to the Owner, any work he executes in violation of Code requirements. Specific references to codes elsewhere in this Division are either to aid the Contractor in locating applicable information or to deny him permission to use options, which are permitted by Codes.
- B. Applicable Codes: (Current editions unless otherwise noted)
  - 1. All local codes; city and/or county as applicable.
  - 2. OSHA requirements
  - 3. California Building Code
  - 4. California Code of Regulations (CCR) Titles (as applicable)
  - 5. Fire Marshal Regulations
  - 6. State, County, City Health Department Ordinances and Regulations
  - 7. Regulations of all other authorities having jurisdiction.
  - 8. California Mechanical Code.
  - 9. California Plumbing Code.
- C. Where conflict or variation exists amongst Codes, the most stringent shall govern.



SUPPLEMENTARY HVAC REQUIREMENTS  
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**1.10 RECORD AND DOCUMENTATION**

- A. Accumulate the following and deliver to the Owner's representative prior to final acceptance of the work.
1. Record (As-Built) Drawings:
    - a. Maintain in good order in the field office a complete set of prints for all work being done under Division 23. Update the drawings daily with neat and legible annotations in red ink showing the work as actually installed.
    - b. The actual size, location and elevation of all buried lines, valve boxes, manholes, monuments, and stubouts shall be accurately located and dimensioned from building walls or other permanent landmarks.
    - c. Furnish the original marked up AS-Built drawings and an electronic copy in AutoCAD-14 format.
  2. Operation and Maintenance Manual: Furnish an operation and maintenance manual covering the stipulated HVAC systems and equipment. Seven copies of the manual, bound in hardback binders or an approved equivalent shall be provided to the Architect.
  3. Furnish one complete manual prior to the time that system or equipment tests are performed.
  4. Furnish the remaining manuals before the contract is completed.
  5. The following identification shall be inscribed on the cover:

OPERATION AND MAINTENANCE MANUAL  
PROJECT TITLE . . . . .  
CONTRACTOR NAME & CONTACT INFORMATION
  6. Provide a Table of Contents.
    - a. Insert tab sheets to identify discrete subjects.
    - b. Instruction sheets shall be legible and easily understood, with large sheets of drawings folded in.
    - c. The manual shall be complete in all respects for all materials, piping, valves, devices and equipment, controls, accessories and appurtenances stipulated. Include as a minimum the following:
      - 1) Updated approved materials lists, shop drawings and catalog information of all items of HVAC system equipment.
      - 2) System layout showing piping, valves and controls.
      - 3) Wiring and control diagrams with data to explain detailed operation and control of each component.
      - 4) A control sequence describing start-up, operation and shutdown.
      - 5) Detailed description of the function of each principal component of the system.
      - 6) Procedure for starting.
      - 7) Procedure for operating.
      - 8) Shut-down instructions.
      - 9) Installation instructions.
      - 10) Adjustments, maintenance and overhaul instructions.
      - 11) Lubrication schedule including type, grade, temperature range and frequency.
      - 12) Safety precautions, diagrams and illustrations.
      - 13) Test procedures.
      - 14) Performance data.
      - 15) Parts list, with manufacturer's names and catalog numbers.
      - 16) Preventive maintenance schedule.
      - 17) Service organization with name, address and telephone number.
      - 18) Valve identification chart and schedule.
      - 19) ASME certificates.
      - 20) Air balance report.
      - 21) Hydronic balance report.

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- B. Standards Compliance: Where equipment or materials are specified to conform to requirements of standards of recognized technical or industrial organizations such as American National Standards Institute (ANSI) American Society for Mechanical Engineers (ASME) American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), American Society for Testing Materials (ASTM), Underwriters Laboratories (UL), American Gas Association (AGA), American Refrigeration Institute (ARI), or National Electrical Manufacturer's Association (NEMA), that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and approved. The label or listing of the specified organization will be acceptable evidence.
- C. Certificates of Conformance or Compliance: Submit original and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply that the product does not meet all requirements.
- D. Certified Test Reports: Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of materials and equipment, submit certified copies of test reports specified in the individual sections.
- E. Factory Tests: Factory tests are tests, which are required to be performed on the actual materials or equipment, proposed for use. Submit results of the tests in accordance with the requirements for laboratory test results of this Contract.
- F. Permits and Certificates of Inspection: Furnish the originals.
- G. Testing procedures and test results required in this and other sections. Furnish 2 copies.
- H. Other data required by other sections of this Division. Furnish 2 copies.

**1.11 CONSTRUCTION COST BREAKDOWN**

- A. Prepare and submit for review a construction cost breakdown for the major subdivisions of the HVAC work in accordance with General and Supplemental Conditions and Project Specification.
- B. Subdivide each item on the breakdown into two headings: labor and materials. Include overhead and profit in each entry.
- C. Submit one copy of the breakdown directly to the Engineer and the remaining copies sent through regular channels.

**1.12 TOOLS**

- A. Provide all special tools needed for proper operation and routine adjustment and maintenance of systems and equipment. Deliver tools to Owner's representative and request a receipt for same.

**1.13 WARRANTIES**

- A. Refer to Project Specification for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.
- B. Where periods more than one year are specified in the specifications, such longer periods shall govern. However, when any component fails at any time during this period, the warranty period for such component and all other components, which are inactive because of, said failure shall be suspended. The warranty period for such components shall resume to-run for the remaining portion of the warranty period when failed component is completely repaired and in operation; however, in no case shall the resumed portion of the warranty period be less than 3 months in duration.
- C. Neither payment for work, nor total or partial occupancy of work by the Owner, within or prior to the warranty period specified, shall be construed as acceptance of faulty work or shall condone any negligence or omission of Contractor in doing the work.
- D. Compile and assemble the warranties specified in Division 23, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

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- E. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names and addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

**1.14 SEISMIC RESTRAINT**

- A. Provide seismic restraint for HVAC equipment, piping, and ductwork.
- B. Contractor shall submit certification of suitability of seismic restraint methods signed by Licensed Structural Engineer registered in State of California.
- C. Contractor may refer to details applicable in the SMACNA, "GUIDELINES FOR SEISMIC RESTRAINT OF HVAC SYSTEMS", using the 'g' forces for "other buildings" classification CCR Title 24 all such details shall be DSA approved. Deliver a copy of these Guidelines to the Owner's Resident Inspector.

**1.15 SYSTEM OPERATIONAL TESTS**

- A. The Contractor shall inform the Owner one week prior to start of testing in order that the Owner's representative may be present.
- B. After balancing and prior to final inspection, the contractor shall operate all systems continuously trouble free and stable for a minimum period of fourteen (14) consecutive days including Saturday and Sunday. Each day shall be a minimum of an 8-hour day. Should a problem arise, the fourteen (14) day period shall be restarted and repeated until successfully operated for full 14 days. A written report certified by the Owner's representative shall indicate the successful completion of a stable and trouble free 14-day period.

**PART 2 - PRODUCTS**

**2.01 MATERIALS AND EQUIPMENT**

- A. Standard Products: Materials and equipment shall be essentially the standard cataloged products of manufacturers regularly engaged in production of such materials or equipment and shall be their latest standard designs that comply with the specification requirements.
- B. Materials and equipment shall duplicate items that have been in satisfactory commercial or industrial use at least two years prior to bid opening, unless more stringent requirements are specified. Where two or more units of the same type of equipment are required, these units shall be products of a single manufacturer. The components thereof, however, are not required to be exclusively of the same manufacturer.
- C. Each major component of equipment shall have manufacturer's name, address, model, and serial number on a nameplate securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.
- D. In these specification and drawings, whenever more than one (1) manufacturer's product is specified, the manufacturer specified on the drawings and the first named product in these specifications is the basis of design and the use of alternate-named manufacturer's product or substitutes shall comply with the requirements of Section 230500.

**2.02 PRODUCT LISTING**

- A. When two or more items of same material or equipment are required (pipe and fittings, pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, sheet metal, wire, steel bar stock, welding rods, solder, fasteners, and similar items used in Work, except as otherwise indicated.

**2.03 NAMEPLATE DATA**

- A. Provide permanent operational data nameplate on each item of power operated HVAC equipment, indicating manufacturer, product name, model name, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

**2.04 SUBSTITUTIONS**

- A. General: Submittals of "Substitutions" shall be in accordance with requirements of Division 01.

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- B. By proposing a substitution, it is deemed that the Contractor shall bear the cost of any and all design and construction changes (whether architectural, structural, electrical, HVAC and Plumbing) necessary to accommodate the substitution, if said substitution is accepted.
- C. Specific: Refer to Specification Sections 230500 & 230512 for additional requirements.

**2.05 SUBMITTALS**

- A. General: Make submittals in accordance with requirements of Division 01.
- B. Specific: Refer to Specification Sections 230500 for additional requirements.

**PART 3 - EXECUTION**

**3.01 WORKMANSHIP AND INSTALLATION METHODS**

- A. Workmanship shall be in the best standard practice of the trade.
- B. Install equipment in accordance with the manufacturer's instructions and recommendations unless otherwise noted or specified.

**3.02 TESTS**

- A. General:
  - 1. Demonstrate that all components of the work of this Division have been provided and that they operate in accordance with the Contract Documents.
  - 2. Provide instruments and personnel for tests and demonstrations. Submit signed test results.
- B. Specific: Refer to the other sections of this Division for test requirements.

**3.03 DELIVERY, HANDLING, STORAGE OF MATERIALS AND PROTECTION OF WORK**

- A. Protect materials against dirt, water, chemical and mechanical damages both while in storage and during construction.
- B. Cover materials in such a manner that no finished surfaces will be damaged, marred or splattered with plaster or paint, and all moving parts will be kept clean and dry.
- C. Replace or refinish any damaged materials including fronts of control panels, ductwork fittings, and shop-fabricated ductwork.
- D. Air distribution systems shall be aggressively protected from dust during the construction process to ensure that no contamination of the duct system occurs.
- E. The use of permanently installed AHUs and associated air distribution systems for temporary heating and cooling during construction is prohibited.
- F. Keep cabinets and other openings closed to prevent entry of foreign matter.
- G. Specific: Refer to other sections of this Division for additional requirements.

**3.04 PROJECT CONDITIONS**

- A. Check and coordinate for clearance, accessibility and placement of equipment either by going through openings provided or by placing equipment during construction. Ordering of equipment to be shipped disassembled, or disassembly of equipment at Project Site and reassembly of equipment to accomplish this requirement shall be executed without additional cost. Where provided openings are inadequate to accommodate equipment, provide new openings and restoration of same, all at no additional cost. Obtain written approval for new openings before proceeding.
- B. Verify location of all equipment within finished spaces with the Architectural Drawings. In the event that HVAC Drawings do not indicate exact locations, or are in conflict with the Architectural Drawings, obtain information regarding proper locations. Installation of work without proper instruction under such circumstances will result in relocation of work, when directed, without additional cost.

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**3.05 INSTRUCTION TO OWNER PERSONNEL**

- A. Contractor shall furnish, without additional expense to the Owner, the services of competent instructors who will give full instruction to the designated personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the equipment or system specified. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance of work. Instruction shall be given at the Owner's convenience. The number of man-days (eight-hours) of instruction furnished shall be as specified in other sections. When more than four man-days of instruction are specified, approximately half of the time shall be used for classroom instruction. All other time shall be used for instruction with the equipment or system. When significant changes or modifications are made under the terms of the contract, provide additional instructions to acquaint the operating personnel with the changes or modifications.
- B. Contractor shall videotape, both visual and audio, instruction to Owner's personnel on the maintenance and operation of the HVAC systems.
- C. Submit certification, signed by Owner's agent that instructions have been completed and the videotape has been reviewed and delivered to the Owner.
- D. Printed operating instructions and a copy of wiring diagrams are to be mounted in all equipment areas, framed and behind glass or encased in plastic. Printed operating instructions shall include steps for starting up and securing equipment. As a precedent to final acceptance four (4) copies of instructions are to be submitted to the Architect for review. Contractor shall turn over to Owner in a neat brochure form, equipment guarantee and maintenance instructions.

**3.06 CLEANING**

- A. Cleaning shall be done as the work proceeds. Periodically remove waste and debris to keep the site as clean as is practical.
- B. Refer the Division 01 for general requirements for cleaning.
- C. Leave exposed parts of the HVAC work in a neat, clean and usable condition, with painted surfaces unblemished and plated metal surfaces polished.
- D. Thoroughly clean all materials, equipment and appliances. Clean and prepare all surfaces to be painted. Clean the entire premises of unused materials, debris, spots and marks to the satisfaction of the Architect.
- E. Remove, thoroughly clean and replace all strainers and automatic valves after the system has been put in operation until system is clear of all foreign matter and repeat this operation after ten (10) days and again after the system has been in operation thirty (30) days. Submit certification that this operation has been completed.

**3.07 SAFETY REQUIREMENTS**

- A. Enclose and guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts in accordance with OSHA requirements. Insulate, guard, and cover any high-temperature equipment and piping so located as to endanger personnel or create a fire hazard.

**END OF SECTION**

**SECTION 23 05 12**  
**HVAC PRODUCT SUBSTITUTIONS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. This Section specifies administrative and procedural requirements for handling requests made after award of the Contract for substitutions of products specified in Division 23.

**1.02 RELATED SECTIONS**

- A. Procedure for Contractor's construction Schedule and the Schedule of Submittals are included under Division 01.
- B. Standards: Refer to Division 01 for applicability of industry standards to products specified.
- C. Procedural requirements governing the Contractor's selection of products and product options are included under Division 01.
- D. Refer to Division 01 for Products and Substitutions.
- E. Refer to Sections 230500 & 230511 for additional requirements.

**1.03 DEFINITIONS**

- A. "Products" is defined to include purchased items for incorporation into the work, regardless of whether specifically purchased for project or taken from Contractor's stock of previously purchased products. "Materials" is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, installed or applied to form units of work.
- B. "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, etc.). Definitions in this paragraph are not intended to negate the meaning of other terms used in contract documents, including "specialties", "systems", "structure", "finishes", "accessories", "furnishings", "special construction", and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

**1.04 SUBSTITUTIONS**

- A. The requirements for substitutions do not apply to specified Contractor options on products and construction methods. Revisions to contract documents, where requested by Owner, Architect or Engineer, are "changes" not "substitutions". Substitutions requested during bidding period, which have been accepted prior to Contract Date, are included in contract document and are not subject to requirements for substitutions as specified herein. Contractor's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute "substitutions"; and do not constitute a basis for change orders, except as provided for in contract documents. Otherwise, contractor's requests of changes in products, materials and methods of construction required by contract documents are considered requests for "substitutions", and are subject to requirements hereof.
- B. Conditions: The Contractor's substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.
  - 1. Extensive revisions to Contract Documents are not required.
  - 2. Proposed changes are in keeping with the general intent of Contract Documents.
  - 3. The request is directly related to an "or approved equal" clause or similar language in the Contract Documents.
  - 4. All costs required to make all necessary revisions and modifications to the contract documents resulting from the substitution, including but not limited to, all professional fees and the cost of DSA approval will be the Contractor's responsibility.

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5. All costs required to make all necessary revisions and modifications to the building structure, electrical and all other related construction costs resulting from the substitution, including but not limited to, material, products, equipment, testing, and inspection will be the Contractor's responsibility.
6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
7. Contractor will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.
8. Contractor certifies that the substitution is not heavier than the specified item and does not necessitate any structural and electrical redesign; will fit within the room or area designed for the specified item; and will not exceed any maximum dimensions specified or shown on the original contract Documents. All roof mounted equipment must be less than or equal to the maximum height dimension from the finished roof as shown on the drawings.
9. Contractor represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified.
10. Contractor represents that he will provide the same warranty for the substitution that he would for that specified.

**1.05 SUBMITTALS**

- A. Requests for Substitutions: Any request for substitution shall follow the guidelines of Substitution Requirements in Division 01, Section 230500 & 230511.
- B. Substitution Warranty: All submittals of Request for Substitutions under the General and Supplementary Conditions of this Section shall be accompanied by a completely executed (filled out) and signed Substitution Warranty in the form entitled "Substitution Warranty", bound herein. Substitutions will not be accepted without the Substitution Warranty. In addition to other requirements, Contractor shall warrant in writing on his own letterhead that substituted materials shall perform as specified, and assume complete responsibility for same, including responsibility and costs required for modifications to building or other materials or equipment, and any additional coordination with work of other trades. Testing, if required, shall be paid by Contractor.
- C. Responsibility of Contractor: The contractor shall be solely and directly responsible for fitting accepted substitute material and equipment into the available space in a manner acceptable to the Architect, and for the proper operation of the substituted equipment with all other equipment with which it may be associated. The Contractor shall bear all costs of meeting the above requirements for presenting a proposed substitution, and if the substitution is accepted, he must bear all costs involved.
- D. Submit the following as part of the Request for Substitutions:
  1. Data showing proposed equipment is "equal" to that specified and is fully equipped, fits the space allotted and has physical configuration and weight similar to the equipment specified in detail.
  2. A complete layout, where applicable, of equipment room or area must be submitted for equipment proposed in "Request for Substitution". Submittal shall conform to requirements of Division 01 and Section 23 0500 "Common Work Results For HVAC" as it applies to "Coordination Drawings."
  3. Seismic Restraint: Where seismic restraint is required for products or equipment as specified, methods of seismic restraint signed by licensed Structural Engineer registered in the State of California, shall be submitted for review to the Division of the State Architect.

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**1.06 ARCHITECT'S ACTION**

- A. The Architect may request additional information or documentation necessary for evaluation of the request. Requests, by the Architect, for additional information or documentation will be in accordance with Division 01 requirements. The Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, Contractor shall use the "Basis of Design" product specified by name in the contract documents. Acceptance will be in the form of a Change Order.

**PART 2 - PRODUCTS**

**2.01 SUBSTITUTIONS**

- A. Substitutions shall conform to the product requirements for the specified products or equipment.

**PART 3 - EXECUTION** (Not Applicable.)

**END OF SECTION**



**SAMPLE**

**SUBSTITUTIONS WARRANTY**

In addition to other requirements, Contractor shall warrant in writing that substituted materials shall perform as specified, and assume complete responsibility for same, including responsibility and costs required for modifications to building or other materials or equipment, and any additional coordination with work of other trades. Testing, if required, shall be paid by contractor. The following is an example of the type Substitution Warranty which shall be executed by the Contractor, on his own letterhead:

**SUBSTITUTION WARRANTY**

We propose to provide

\_\_\_\_\_  
(Describe items being proposed for substitution)

for \_\_\_\_\_ in lieu of  
(List project name)

as indicated on the drawings and described in Section \_\_\_\_\_ of the Specifications.

We agree to assume the cost of any and all modifications to the Contract Documents and to other portions of the work as indicated in the Specification Sections 230500, 230511, & 230512, and as necessary to accommodate for substituted material(s) and system(s) as indicated in this letter of "Substitution Warranty".

We hereby warrant that \_\_\_\_\_  
(Provide Description)

is the equivalent of \_\_\_\_\_  
(Specified Product)

in every respect and will perform satisfactorily under the conditions and use indicated on the Drawings and described in the Specifications.

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

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

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

NOTE: Affix Corporate Seal over Signatures.

## **SECTION 23 05 13**

### **COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT**

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

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

- A. This Section specifies the basic requirements for electrical components, which are an integral part of packaged HVAC equipment. These components include, but are not limited to factory-installed motors, starters, and disconnect switches furnished as an integral part of packaged HVAC equipment.
- B. Specific electrical requirements (i.e. horsepower and electrical characteristics) for HVAC equipment are scheduled on Drawings.
- C. All motors, power driven equipment and automatic control equipment, except motor starters as hereinafter set forth required and connected with the work of this section of the specifications are to be furnished and installed under Division 23.
- D. Control low (24V) and control line (120V) voltage wiring, conduit and related switches and relays required for the automatic control and/or interlock of motors and equipment includes final connection, are to be furnished and installed under Division 23. Materials and installation to conform to Class 1 or 2, CAC Title 24, Article E725, and as restricted under Division 26 of these specifications.
- E. Power wiring, conduit, out-lets, disconnect switches, motor starters and motor-rated contactors, and making of final connections, except as hereinafter specified, are to be furnished and installed under the Division 26 of these Specification.
- F. All power supply wiring for providing a power source to control dampers, control valves, VAV boxes, control transformers, etc., shall be furnished and installed under Division 23.
- G. Identify circuits and equipment as outlined in the Electrical Sections of these Specifications.
- H. Coordinate requirements for underground conduit only between buildings for control interlocks shown on the drawings. This conduit to be furnished and installed under Division 26 of these Specifications.
- I. Space provisions have been made on electrical panels for control power source.

##### **1.02 RELATED SECTIONS**

- A. Separate electrical components and materials required for field installation and electrical connections are specified in Division 26.
- B. This section applies to all Division 23 sections specifying packaged HVAC equipment.

##### **1.03 REFERENCES**

- A. NEMA Standards MG 1: Motors and Generators.
- B. NEMA Standards ICS 2: Industrial Control Devices, Controllers, and Assemblies.
- C. NEMA Standard 250: Enclosures for Electrical Equipment.
- D. NEMA Standard KS 1: Enclosed Switches.
- E. Comply with National Electrical Code (NFPA 70).

##### **1.04 SUBMITTALS**

- A. No separate submittal is required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections.

##### **1.05 QUALITY ASSURANCE**

- A. Electrical components and materials shall be UL labeled.

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**PART 2 - PRODUCTS**

**2.01 MOTORS**

- A. Provide all motors necessary for equipment under the HVAC Work. See Electrical Drawings for voltage and phase of electrical services.
- B. The following are basis requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.
  - 1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
  - 2. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range.
  - 3. 2-speed motors shall have 2 separate windings on poly-phase motors.
  - 4. Temperature Rating: As a minimum motors shall be rated for 40 degree C environment with maximum 50 degree C temperature rise for continuous duty at full load (Class A Insulation).
  - 5. Starting capability: Frequency of starts as indicated by automatic control system, and not less than 5 evenly time spaced starts per hour for manually controlled motors.
  - 6. Service Factor: 1.23 for poly-phase motors and 1.35 for single-phase motors.
  - 7. Motor construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.
    - a. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.
    - b. Bearings:
      - 1) Ball or roller bearings with inner and outer shaft seals.
      - 2) Re-greasable bearings, except permanently sealed where motor is normally inaccessible for regular maintenance.
      - 3) Bearings designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
      - 4) Bearings for fractional horsepower, light duty motors, sleeve type bearings are permitted.
    - c. Enclosure Type:
      - 1) Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation.
      - 2) Guarded drip-proof motors where exposed to contact by employees or building occupants.
      - 3) Weather protected Type I for outdoor use, Type II where not housed (Epoxy encapsulated or TEFC).
    - d. Overload protection: Polyphase built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter. Single phase, provide thermal overload protection.
    - e. Noise rating: "Quiet".
    - f. Efficiencies shall be guaranteed minimum values in accordance with the following tabulation. Efficiencies shall be established in accordance with NEMA Test Standards MG1-12.53A using IEEE Test Procedure 112, Method B:

HP	EFFICIENCY
1 - 2	81.5
3 - 5	86.5
7-1/2 - 10	90.6
15 - 30	92.0

- g. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.
- h. Provide all motors with junction boxes or terminals boxes and provide adjustable slide rails for all motors with belt drives.

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- i. Motors rated 1 HP and larger shall have shaft, bearings and etc. capable of operating with multiple grooved sheaves and two or more belts.
- j. V Type Belt Drives: Drives requiring not more than 2 belts; variable pitch type; size for mid-point of operating range. Drives requiring 3 or more belts; nonadjustable constant speed type. Provide belts in matched sets.

**2.02 MOTOR STARTERS**

- A. Unless provided as part of packaged HVAC equipment or otherwise indicated, starters for motors will be provided under Division 26. Provide to Division 26 the data necessary for motor starter heater sizing for all motors.
- B. Starters for factory packaged HVAC equipment specified under Division 23 shall be provided as part of the package.
- C. Motor Starter Characteristics:
  - 1. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R with conduit hubs, or units in hazardous locations, which shall have NEC proper class and division.
  - 2. Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and start-up condition.
- D. Manual switches shall have:
  - 1. Pilot lights and extra positions for multi-speed motors.
  - 2. Overload protection: melting alloy type thermal overload relays.
- E. Magnetic Starters:
  - 1. Maintained contact push buttons and pilot lights, properly arranged for single speed or multi-speed operation as indicated.
  - 2. Trip-free thermal overload relays, each phase.
  - 3. Interlocks, switches and similar devices as required for coordination with control requirements.
  - 4. Built-in control circuit transformer, fused from line side, where service exceeds 240 volts.
  - 5. Externally operated manual reset.
  - 6. Under-voltage release or protection.
- F. Motor Connections:
  - 1. Flexible conduit, except where plug-in electrical cords are specifically indicated.

**2.03 DISCONNECT SWITCHES**

- A. When applied as part of factory furnished and mounted equipment, disconnects shall meet the requirements for disconnect switches set forth in Division 26.

**PART 3 - EXECUTION**

**3.01 SEISMIC RESTRAINT**

- A. All electrical devices shall be seismically restrained.

**END OF SECTION**

**SECTION 23 05 14**  
**SELECTIVE HVAC DEMOLITION**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. This Section includes limited scope of selective HVAC demolition work as follows:
  - 1. Nondestructive removal of materials and equipment for reuse or salvage as indicated.
  - 2. Dismantling HVAC materials and equipment made obsolete by these installations.

**1.02 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 01 and Division 23 Specification Sections.
- B. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut-off of utility services and details for dust and noise control.
  - 1. Coordinate sequencing and Owner occupancy specified in Division 01.
  - 2. Coordinate other selective demolition work as outlined in Division 01.

**1.03 PROJECT CONDITIONS**

- A. Conditions Affecting Selective Demolition: The following project conditions apply:
  - 1. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
  - 2. Locate, identify, and protect HVAC services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas. Provide minimum of 72-hour notice to Owner prior to utility interruption.

**1.04 SEQUENCE AND SCHEDULING**

- A. Coordinate the shut-off and disconnection of utility services with the Owner and the utility company.
- B. Notify the Architect at least 7 days prior to commencing demolition operations.
- C. Perform demolition in phases as indicated.

**PART 2 - PRODUCTS (Not Applicable)**

**PART 3 - EXECUTION**

**3.01 EXAMINATION**

- A. Examine areas where selective demolition is to occur. Determine extent of work and affect on existing conditions to remain. Advise Architect of any conditions that might create extensive alterations beyond indicated scope.

**3.02 SELECTIVE DEMOLITION**

- A. General: Demolish, remove, demount, and disconnect abandoned HVAC materials and equipment indicated to be removed and not indicated to be salvaged or saved.
- B. Materials and Equipment To Be Salvaged: Remove, demount, and disconnect existing HVAC materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.
  - 1. Protect all removed and salvaged equipment from being damaged during the demolition work.
- C. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.

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- D. HVAC Materials and Equipment: Demolish, remove, demount, and disconnect the following items:
1. Inactive and obsolete piping, fittings and specialties, equipment, air distribution ductwork and all associated accessories, controls, fixtures, and insulation.
    - a. Obtain written approval from Architect and owner for piping and ducts embedded in floors, walls, and ceilings which may remain if such materials do not interfere with new installations.
      - 1) Drain and cap piping and ducts allowed to remain.
    - b. Remove materials above accessible ceilings.
  2. Perform cutting and patching required for demolition.

**END OF SECTION**

**SECTION 23 05 15**  
**ACCESS DOORS AND PANELS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. This Section includes limited scope of general construction materials and methods for access doors and panels in walls and ceilings for access to HVAC materials.
- B. Requirements of access doors are outlined in Division 08.
- C. Access doors and panels are required for all HVAC equipment requiring maintenance, inspection, adjustment, monitoring, etc... which are installed in inaccessible areas such as behind walls, above ceiling, under floor, etc.

**1.02 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of access door or panel.

**1.03 QUALITY ASSURANCE**

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer Qualifications: Engage an experienced Installer for the installation of access panels and doors.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:
  - 1. Elmdor / Stoneman.
  - 2. Jay R. Smith Mfg. Co.
  - 3. Milcor Inc.

**2.02 ACCESS DOORS**

- A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
- B. Frames: 16-gage steel, with a 1-inch-wide exposed perimeter flange.
  - 1. For installation in masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling: 1 inch-wide-exposed perimeter flange and adjustable metal masonry anchors.
  - 2. For gypsum wallboard or plaster: perforated flanges with wallboard bead.
  - 3. For full-bed plaster applications: galvanized expanded metal lath and exposed casing bead, welded to perimeter frame.
- C. Flush Panel Doors: 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.
  - 1. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.
- D. Locking Devices: Flush, screwdriver-operated cam locks.

**PART 3 - EXECUTION**

**3.01 EXAMINATION**

- A. Examine areas and conditions under which access door and panel products are to be installed. Do not proceed with work until unsatisfactory conditions have been in manner acceptable to Installer.

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**3.02 APPLICATION**

- A. Nonrated Walls and Ceilings: Prime coat finish door and frame, Allen key latch face of wall type; Smith 4760, Elmdor / Stoneman DW Series.
- B. Fire Rated Walls and Ceilings: "B" Labeled U.L. 1-1/2 hours, prime coat finish door and frame, flush keyed cylinder lock; Milcor.
- C. Tile Walls: Cover and frame 18-8 satin stainless steel, face-of-wall type, vandal resistant screws; J. R. Smith 4762, Elmdor / Stoneman DW Series.

**3.03 INSTALLATION OF ACCESS DOORS**

- A. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
- B. Adjust hardware and panels after installation for proper operation.

**3.04 COORDINATION**

- A. General: Coordinate locations of ceilings access doors with lights, air outlets, speakers, etc. Submit drawings showing relative locations of doors to other ceiling items for acceptance by the Architect prior to installation. Transparencies of floor plans and/or reflected ceiling plans will be available from the Architect for this purpose.
- B. Location: Doors may be located to serve more than one item where feasible, providing they are approved as specified. Sizes suitable for purpose intended, with 12" x 12" minimum.
- C. Access doors and panels not required in accessible ceiling systems where direct access to HVAC items is possible.

**END OF SECTION**



**SECTION 23 0529**  
**SUPPORTS AND ANCHORS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Extent of supports and anchors required by this section is indicated on drawings or in other Division 23 sections and include the following:
  - 1. Horizontal-Piping Hangers and Supports;
  - 2. Vertical-Piping Clamps;
  - 3. Hanger-Rod Attachments;
  - 4. Building Attachments;
  - 5. Saddles and Shields;
  - 6. Miscellaneous Materials;
  - 7. Anchors;
  - 8. Equipment Supports.

**1.02 RELATED SECTIONS**

- A. This section is part of each Division 23 section making reference to or requiring supports and anchors specified herein.
- B. Supports and anchors furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 23 sections.
- C. Section 033000: Cast-in-Place Concrete.

**1.03 QUALITY ASSURANCE**

- A. Codes and Standards:
  - 1. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.
  - 2. UL and FM Compliance: Provide products which are UL-listed and FM approved.
  - 3. MSS Standard Compliance:
    - a. Provide pipe hangers and supports of which materials, design, and manufacturer comply with MSS SP-58.
    - b. Select and apply pipe hangers and supports, complying with MSS SP-69.
    - c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
    - d. Terminology used in this section is defined in MSS SP-90.

**1.04 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURED UNITS**

- A. Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS SP-58.
  - 1. Components shall have galvanized coatings where installed for piping and equipment that will not have field-applied finish.
  - 2. Pipe attachments shall have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Thermal Hanger Shield Inserts: 100 PSI average compressive strength, waterproofed calcium silicate, encased with a sheet metal shield. Insert and shield shall cover entire circumference of the pipe and shall be of length indicated by manufacturer for pipe size and thickness of insulation.

## **2.02 HORIZONTAL PIPING HANGERS AND SUPPORTS**

- A. General: Except as otherwise indicated, provide factory fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
  - 1. Adjustable Steel Clevis Hangers: MSS Type 1.
  - 2. Adjustable Swivel Pipe Rings: MSS Type 6.

## **2.03 VERTICAL PIPING CLAMPS**

- A. General: Except as otherwise indicated, provide factory fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
- B. Two-Bolt Riser Clamps: MSS Type 8.

## **2.04 HANGER ROD AND BUILDING ATTACHMENTS**

- A. General Hanger Rod Attachment: Refer to structural drawings for requirements of hanger rod and building attachments. If a specific attachment that is required is not detailed on the structural drawings, one of the following attachments may be submitted for review by the structural engineer prior to installation. Except as otherwise indicated, provide factory fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachment to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
- B. General Building Attachment: Except as otherwise indicated, provide factory fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
  - 1. Concrete Inserts: MSS Type 18.
  - 2. Center Beam Clamps: MSS Type 21.
  - 3. Steel Beam Clamps W/Eye Nut: MS Type 28.
  - 4. Linked Steel Clamps W/Eye Nut: MSS Type 29.
  - 5. Malleable Beam Clamps: MSS Type 30.
  - 6. Steel Brackets: One of the following for indicated loading:
  - 7. Light Duty: MSS Type 31.

## **2.05 SADDLES AND SHIELDS**

- A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
- B. Protection Shields: MSS Type 40; provide high density insert of same thickness of insulation.

## **2.06 MANUFACTURERS OF HANGERS AND SUPPORTS**

- A. Manufacturers: Subject to compliance with requirements, provide hangers and supports of one of the following:
  - 1. B-Line Systems, Inc.
  - 2. Tolco, Inc.
  - 3. Elcen Metal Products Co.
  - 4. Fee & Mason Mfg. Co.; Div. Figgie International.

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5. ITT Grinnel Corp.

## **2.07 MISCELLANEOUS MATERIALS**

- A. Steel Plates, Shapes and Bars: ASTM A36.
- B. Cement Grout: Portland cement (ASTM C150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.
- C. Pipe Alignment Guides: Factory fabricated, of cast semisteel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.
- D. Pipe Roll Stand: Factory fabricated cast iron stand, size as required, with insulation installed on piping.

## **2.08 ISOLATORS**

- A. Isolators: Provide factory-fabricated isolators of size required.
- B. Spring Isolators: Refer to Section 230548 "Vibration Control For HVAC."

## **PART 3 - EXECUTION**

### **3.01 INSPECTION**

- A. Examine substrates and conditions under which supports and anchors are to be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachment.
- B. Prior to installation of hangers, supports, anchors and associated work, installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

### **3.03 INSTALLATION OF BUILDING ATTACHMENTS**

- A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top of inserts.

### **3.04 INSTALLATION OF HANGERS AND SUPPORTS**

- A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and type as installed for adjacent similar piping.

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- C. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.
- D. Provisions of Movement: Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors.
- E. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- F. Pipe Slopes: Install hangers and supports to provide required pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
- G. Bare Piping: Install isolators for all bare domestic water and bare hydronic piping.
- H. Insulated Piping: Comply with the following installation requirements.
  - 1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
  - 2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields. Provide rigid insulation reinforcement at shields.
- I. Hangers and supports to be capable to resist the minimum seismic forces indicated in drawings.

**3.05 EQUIPMENT SUPPORTS**

- A. Concrete housekeeping bases will be provided as work of Division 03.
- B. Furnish to Contractor, scaled layouts of all required bases, with dimensions of bases, and location to column center lines. Furnish templates, anchor bolts, and accessories, necessary for base construction.

**3.06 ADJUSTING AND CLEANING**

- A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
- B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
- D. Touch-Up Painting: Immediately after erection of anchors and supports, clean field welds and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA-1 requirements for touch-up of field-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- E. For galvanized surfaces clean welds bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A-780.

**END OF SECTION**

**SECTION 23 05 48**  
**VIBRATION CONTROL FOR HVAC**

**PART 1 - GENERAL**

**1.01 DESIGN REQUIREMENTS**

- A. It is the intent of this Specification to provide the necessary design for the avoidance of excessive noise or vibration in the building due to the operation of machinery or equipment, or due to interconnected piping, ductwork, or conduit and to seismically restraint piping, ductwork and equipment per the applicable codes against seismic forces in any direction.
1. All isolators shall:
    - a. Be provided by a single manufacturer.
    - b. Be designed or treated for resistance to corrosion. Structural steel bases shall be cleaned of welding slag and coated with an SCAQMD compliant primer.
    - c. Be selected to perform their function without undue stress or overloading. All isolators shall have a method for leveling and have a 1/4" thick ribbed neoprene acoustical pad under the spring baseplate.
    - d. Be installed in a manner to prevent the transmission of vibration to the structure. No rigid connections between rotating or oscillating equipment or piping and the building will be permitted.
    - e. Be designed to be non-resonant with equipment forcing frequencies or support structure natural frequencies.
  2. Anchor floor mounted isolated equipment to concrete housekeeping pads of sufficient size to accommodate the anchorage of seismic restraints. Housekeeping pads shall be anchored to the structure as specified by the Structural Engineer of Record.
  3. Each fan and motor assembly shall be supported on a single structural steel frame. Flexible duct connections shall be provided at inlet and discharge ducts.
  4. Where called for in the specifications or on the drawings, all structural steel bases, including concrete pouring form bases, shall be designed and fabricated by the isolation manufacturer. Isolation manufacturer shall be a licensed fabricator for the City of Los Angeles, California.
  5. Unless otherwise indicated, all equipment mounted on vibration bases shall have a minimum operating clearance of 1" between structural steel base and floor or support base beneath. The minimum operating clearance between concrete inertia bases and housekeeping pads shall be 1 inch. Check clearance space after installation to ensure that no debris has been left to possibly short circuit isolation bases.
  6. Where necessary due to height limitations, provide height saving brackets.
  7. Design isolators for positive anchorage against uplift and overturning.

**1.02 MANUFACTURERS**

- A. Acceptable Isolation Manufacturer:
1. M. W. Sausse' & Co., Inc. (Vibrex)
  2. Mason Industries, Inc
  3. Or Approved Equal.
- B. Purchased and/or fabricated equipment must be designed and manufactured with provision for positive anchorage against seismic forces.
- C. Seismic restraints for pipes and ducts shall be as per the SMACNA Guidelines for seismic Restraint of Mechanical Systems and shall be approved by DSA.
- D. Seismic restraints for equipment and piping shall be designed to meet the criteria of the current California Code of Regulations.
- E. The manufacturer of Vibration Isolation and Seismic Control Equipment shall have the following responsibilities:
1. Determine adequate vibration isolation and seismic restraint sizes and locations.

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2. Provide piping and equipment isolation systems and seismic restraints as scheduled and/or specified.
3. Provide installation instructions and drawings to assure proper installation and performance.

### 1.03 SUBMITTALS

- A. Make Submittals in Accordance with:
  1. Contract General Provisions - Division 01.
  2. Mechanical General Provisions - Sections 230500 and 230511.
- B. Submit Shop Drawings and Manufacturer's Literature
  1. Specific vibration isolators and seismic restraints to be utilized showing compliance with the specifications.
  2. Isolation frame construction for each machine including dimensions, structural member sizes, support points and restraint locations and details.
  3. Methods for isolation and restraint of suspended piping, ductwork, and equipment.
  4. Methods for guides and isolation of piping risers.
  5. Seismic restraint calculations signed and stamped by an engineer licensed in the State of California and experienced in the design of isolation and seismic restraint for flexibly mounted equipment.

## PART 2 - PRODUCTS

### 2.01 VIBRATION ISOLATOR TYPES

- A. "RMS" shall be a laterally stable un-housed spring isolator. Spring, top plate, and baseplate assembly shall be welded. Mounting shall comply with all requirements stated in paragraph above.
- B. "RMSG" shall be the same as "RMS" above, but shall include height saving brackets for attachment to the equipment frame or isolation base.
- C. "RMSP-EQ" shall be the same as "RMS" above except that the spring shall be enclosed in a welded steel cylinder with uplift restraints for horizontal and vertical seismic control.
- D. "RMLS-EQ" shall be the same as "RMS" above, and shall be equipped with a steel housing designed for seismic restraint and with vertical limit stops to prevent the equipment changing from its loaded height should it be necessary to remove a portion of its weight. This housing may also be used as rigid blocking during rigging so that the installed height and the operating height of the isolated equipment remain the same. O.S.H.P.D. pre-approval # OPA-0029.
- E. "RMLS-SB" shall be a steel frame constructed of structural wide flange members unless shown otherwise and shall be rectangular in shape. The depths of the steel members shall not be less than one tenth (1/10) of the longest span between base supports or designed for a maximum beam deflection of .005". If the latter method is used, submittals shall include calculations showing the necessary moment of inertia. All steel members shall be coped and fitted, or constructed using the overlap insert method to assure a structural strength that is greater than the individual member strength. The steel frame is placed directly on top of the RMLS-EQ type isolators. O.S.H.P.D. Pre-approved isolator/seismic restraints.
- F. "RMU-EQ-SH": shall be an individual semi-housed steel spring isolator complete with vertical motion limit stops incorporating seismic restraints, leveling, and ribbed neoprene pad bonded to the base-plate. O.S.H.P.D. pre-approval # OPA-0098.
- G. "AS" shall be air spring isolators and shall incorporate the following:
  1. A complete vibration isolation system consisting of a minimum of three air springs and a total of three height sensing valves. If there are two or more air springs per location, they shall be connected to the outlet of the height control valve in parallel. An associated interconnecting air supply system is required which is not included in this work.
  2. The air spring shall operate at its normal operating height and the maximum pressure shall not exceed the manufacturer's recommended rating of 100 PSI. The system shall maintain an elevation of +/- 1/8", once adjusted.

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3. The type air spring to be utilized shall be based upon the required natural frequency as indicated in the schedule. In order to avoid instability, auxiliary height saving brackets, housings, etc. may be utilized, subject to approval.
- H. "RP-EQ" shall be a rubber pad type elastomer mounting, consisting of a steel bearing plate with 1/4" thick neoprene ribbed acoustical pad. Maximum loading shall be 60 PSI. Proper anchorage for seismic loads shall be indicated on drawings.
- I. FUD-EQ shall be rubber-in-shear isolators incorporating mounting bolts for bolting to equipment base, a bottom steel plate for bolting isolator to sub base or structure, and built in seismic restraints.
- J. "RMXA" shall be a rectangular steel housing that shall be bolted to the overhead structure and designed to allow up to 30 degrees rod misalignment. Hanger shall consist of a steel spring located in a molded neoprene retaining cup with hanger rod bushing.
- K. "PRMXA" - Same as type "RMXA" with the addition of a steel load transfer plate so that the equipment or piping operating height is the same as the installed height.
- L. "HXA" -Same as type "RMXA" with the addition of a neoprene element in series to isolate the upper connection.
- M. "PHXA" - Same as type "HXA" with the addition of a steel load transfer plate so that the equipment or piping operating height is the same as the installed height.
- N. "HSS" - shall be a 'rubber in shear' isolator element contained within a rectangular steel housing.

## **2.02 RAIL AND BASE TYPES**

- A. "RMR" spring rail isolator. Rails shall have springs of proper size and constant, installed between a continuous structural steel channel (upper member) and a continuous flat steel plate (bottom member) in such manner, quantity, and location that efficient uniform deflection and loading to the structure is assured. Rails shall be furnished with Vibrex hold down stabilizers to restrict excessive amplitudes. Cross bracing must be used when necessary for seismic stability.
- B. "RMB" shall be the same as "RMR" above except that it shall be designed as an integral fan and motor base with an adjustable motor slide base.
- C. "RMSR" shall be a set of wide flange structural steel rails supplied with height saving brackets to reduce the mounting height of the equipment. The maximum allowable deflection of any point on the loaded frame relative to the unloaded frame shall be 0.005". A wide flange section depth greater than 1/10 the supporting span between isolators will be accepted as satisfying the deflection requirement.
- D. "RMSB" shall be a steel frame constructed of structural wide flange members unless shown otherwise and shall be rectangular in shape. The depths of the steel members shall not be less than one tenth (1/10) of the longest span between base supports or designed for a maximum beam deflection of .005". If the latter method is used, submittals shall include calculations showing the necessary moment of inertia. All steel members shall be coped and fitted, or constructed using the overlap insert method to assure a structural strength that is greater than the individual member strength. Adjustable motor slide bases shall be included when required for centrifugal fan applications. The steel bases shall have an operating clearance of one (1") inch above the supporting structure. Where bases are used to mount pumps, the bases shall be large enough to support the pipe elbows if required.
- E. "RMSBI" shall be a steel frame inertia base with all welded members and constructed of structural channel shapes. The base shall be designed for a thickness or inertia mass to equipment weight ratio as shown on the schedule with a minimum thickness of six (6") inches. The bases shall include a template and anchor bolts to anchor the equipment. Inertia bases shall have 1/2" (#4) rebar spaced a maximum of 12" on centers in each direction and located 1-1/2" from the bottom of the base. Adjustable motor slide bases shall be included when required for centrifugal fan applications. Bases shall be supplied with height saving brackets to reduce the mounting height of the equipment.

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- F. "RMUAB-EQ" shall be a steel frame made of structural angle with type "RMU-EQ-SH" O.S.H.P.D. pre-approved combination isolator/restraints.
- G. "RMLSR" shall be a set of multiple wide flange structural steel rails supplied with type RMLS-EQ vibration isolator/seismic restraints and height saving brackets to reduce the mounting height of the equipment. The maximum allowable deflection of any point on the loaded frame relative to the unloaded frame shall be 0.005". A wide flange section depth greater than 1/10 the supporting span between isolators will be accepted as satisfying the deflection requirement.
- H. Type "RMLSB" shall be a steel frame constructed of structural wide flange members unless shown otherwise and shall be rectangular in shape. The depths of the steel members shall not be less than one tenth (1/10) of the longest span between base supports or designed for a maximum beam deflection of .005". If the latter method is used, submittals shall include calculations showing the necessary moment of inertia. All steel members shall be coped and fitted, or constructed using the overlap insert method to assure a structural strength that is greater than the individual member strength. Frame shall be supplied complete with height saving brackets and type RMLS-EQ, O.S.H.P.D. pre-approved isolator/seismic restraints.
  - 1. Type RMLS-SB is the same as type "RMLSB" but rather than utilizing height saving brackets the steel frame is placed directly on top of the RMLS-EQ type isolators.

### 2.03 CURB TYPES

- A. Type "VIC-EQ-SS" shall be a factory fabricated combination roof mounting curb and vibration isolation base for rooftop package units over 25 tons. The curb assembly shall be designed so that it can be re-roofed without disturbing the HVAC equipment. Curbs must be designed so that roofing material cannot cover access to isolators. The vibration isolation portion of the assembly shall be constructed of structural steel and designed to mate with the bottom of the rooftop unit. System shall include factory fabricated duct supports and any required bracing welded in place. The sheet metal weather proofing curb portion shall be supplied complete with a wood-nailer strip to facilitate flashing by the roofing contractor. Internal vibration isolator/seismic restraints shall be OSHPD pre-approved number OPA-0029 as manufactured by MW Sausse' & company, inc. Required anchorage calculations shall be supplied with submittal package. When required, curb shall include an optional acoustical package for sound reduction.
- B. Type "VIC-EQ" shall be a factory fabricated combination roof mounting curb and vibration isolation base for rooftop package units up to 20 tons. Steel members and cross bracing shall all be welded. The assembly shall be shipped and installed in one piece complete with curb, weather-seal, removable OSHPD pre-approved isolator/restraints #OPA-0098, exterior accessible leveling device, and minimum 14 gage galvanized steel top section to match the unit. Curb shall be fabricated of minimum 12 gage galvanized steel designed to carry the seismic loads to the supporting structure. System shall include factory fabricated duct supports welded in place as well as insulated panels when required. Required anchorage and lower curb structural calculations shall be supplied with submittal package. When required, curb shall include an optional acoustical package for sound reduction. Curb shall be manufactured to match roof slope if specified in drawings.

### 2.04 SEISMIC RESTRAINTS

- A. Shall be capable of safely accepting external forces as specified in the applicable codes without failure. Restraints shall maintain equipment, duct, and piping in a captive position during an earthquake. Restraints shall not short circuit vibration isolation systems or transmit objectionable vibration or noise under normal operating conditions. Seismic restraints shall be provided on all equipment as scheduled on the drawings. Submit calculations by a Licensed Structural Engineer Registered in State of California to verify snubber capacities.
- B. Type "3500" seismic restraint shall be constructed of steel plate, concentric steel pipes, and structural members in an all welded assembly. All contact points shall be cushioned with minimum 1/4" thick resilient pad. Restraints shall be O.S.H.P.D pre-approved type OPA-0029.



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- C. Type "3200" seismic restraint shall be all directional type with interlocking steel members constructed of structural angle and A-36 threaded rod. All contact points shall be cushioned with minimum 1/4" thick resilient pad or bushing.
- D. Type "CR" seismic restraints shall be constructed of 7x19 strand galvanized aircraft cable. Cable assembly shall come complete with minimum (2) "U" bolt clamps per end and thimbles to protect cable from chafing. Allowed loads shall be the cable breaking strength with a safety factor of three. Actual loads shall be calculated with the worst case of all load applied to one cable and anchor pattern. Cable shall be installed with 1/4" slack to prevent the transmission of vibration to the structure.

### **PART 3 - EXECUTION**

#### **3.01 GENERAL**

- A. Install in accordance with manufacturer's written instructions. Vibration isolators must not be installed in a manner that will result in piping stress or misalignment.
- B. The structural steel or concrete inertia base shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the equipment or isolators. The isolators shall be installed without raising the equipment and frame assembly.
- C. After the entire installation is complete and under full operational load, the isolator shall be adjusted so that the load is transferred from the blocks or shims to the isolator. When all isolators are properly adjusted, the blocks or shims shall be barely free and shall be removed.
- D. Once the equipment is in operation, install and anchor the seismic restraints with proper operating clearances as indicated on drawings.
- E. HVAC equipment shall be isolated from the building structure by vibration isolators as scheduled on the drawings.
- F. All piping 1 1/4" and over located in mechanical equipment rooms, and for a minimum of fifty (50) feet or 100 pipe diameters whichever is greater, from connection to vibrating mechanical or electrical equipment, shall be isolated from the building structure by means of vibration isolators as identified above.
- G. All HVAC piping and vertical risers shall be isolated from the building structure by means of vibration isolators and guides.
- H. All piping and ductwork to be isolated shall freely pass through walls and floors without contact. Penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork and maintain adequate clearance (Minimum of 2 inches all around) around the outside surfaces. Any materials used to fill the clearance space shall be permanently flexible so that vibration will not pass through it.
- I. No rigid connections between equipment and building structure, including electrical conduit and refrigerant lines, shall be made that degrades the vibration isolation system herein specified. Inform other following trades, such as plastering, or electrical, to avoid any contact which would short-circuit the vibration isolation.
- J. Bring to the Architect's attention prior to installation any conflicts with other trades which will result in unavoidable rigid contact with equipment or piping as described herein, due to inadequate space or other unforeseen conditions. Corrective work necessitated by conflicts after installation shall be at the contractor's expense.
- K. Bring to the Architect's attention any discrepancies between the specifications and field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the contractor's expense.
- L. Obtain inspection and approval of any isolation installation to be covered or enclosed, prior to such closure.

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- M. Thrust restraints shall consist of spring hangers with the same deflection as specified for the spring mountings. Thrust restraints shall be attached to the fan at the centerline of air discharge opening.
- N. Correct, at no additional cost, all installations that are deemed defective in workmanship or materials.

**3.02 PIPING ISOLATORS**

- A. All piping except fire standpipe systems are included under this section.
- B. Isolate piping within 50 feet of rotating equipment and pressure reducing stations.
- C. The isolators shall be installed with the isolator hanger box attached to, or hung as close as possible to, approved locations on the supporting structure.
- D. The isolators shall be suspended from substantial structural members, not from slab diaphragm unless specifically permitted.
- E. Hanger rods shall be aligned to clear the hanger box.
- F. Horizontal floor supported piping shall be isolated by type "RMLS-EQ", with a minimum static deflection of 1.0 inch or the same deflection as isolated equipment to which pipe is connected, whichever is greater.
- G. Vertical riser pipe support and restraint system shall consist of type "RMS" springs and type "PG-EQ" guides. Install vertical riser guides so that clearances are maintained around concentric pipes in the guides. Install vertical restraints on the floor location as shown on drawings.
- H. Pipe anchors, where required, shall utilize resilient pipe anchors, type "RPA" or equivalent, to avoid direct contact of piping with building.
- I. Pipe Extension and Alignment connectors: Provide connectors at pump suction and discharge, riser take offs, cooling and heating coils, and elsewhere as required to accommodate thermal expansion and misalignment.
- J. Seismic restraint spacing shall be in accordance with applicable codes.

**3.03 INSPECTION**

- A. On completion of installation of all vibration isolation and seismic control devices herein specified, the local representative of the isolation materials manufacturer shall inspect the completed system and report in writing any installation error, improperly selected isolation devices, or other faults in the system that could affect the performance of the system. The contractor shall submit a report to the Architect, including the above report with consequent steps taken to properly complete the isolation work.

**END OF SECTION**

**SECTION 23 05 53**  
**HVAC IDENTIFICATION**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Extent of HVAC identification work required by this section is indicated on drawings or specified in other Division 23 sections, and includes the following:
  - 1. Painted Identification Materials;
  - 2. Plastic Pipe Markers;
  - 3. Plastic Tape;
  - 4. Underground-Type Plastic Line Marker;
  - 5. Plastic Duct Markers;
  - 6. Valve Tags;
  - 7. Diagram and Schedule Frames;
  - 8. Engraved Plastic-Laminate Signs;
  - 9. Plastic Equipment Markers;
  - 10. Plasticized Tags.

**1.02 RELATED SECTIONS**

- A. This section is part of each Division 23 section making reference to identification devices specified herein.
- B. HVAC identification furnished as part of factory-fabricated equipment is specified as part of equipment assembly in other Division 23 sections.
- C. Refer to Division 26 Sections for identification requirements of electrical work; not work of this section.

**1.03 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.
- B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.
- C. Schedules and Diagrams:
  - 1. Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule.
  - 2. Submit temperature control diagrams and Sequence of Operation on bond paper suitable for framing.
- D. Maintenance Data: Include product data and schedules in maintenance manuals; in accordance with requirements of Division 01 and Division 23 Section 230511 "Supplementary HVAC Requirements".

**1.04 QUALITY ASSURANCE**

- A. Codes and Standards:
  - 1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
  - 2. No adhesive type identification markers will be accepted. All markers and tags shall be permanently attached to pipe, etc.
  - 3. All identification markers installed exterior of buildings shall be ultra-violet resistant.

## **PART 2 - PRODUCTS**

### **2.01 ACCEPTABLE MANUFACTURERS**

- A. Manufacturer: Subject to compliance with requirements, provide HVAC identification materials of one of the following:
  - 1. Seton Name Plate Corp.
  - 2. Allen Systems, Inc.
  - 3. Brady (W.H.) Co.; Signmark Div.
  - 4. Industrial Safety Supply Co., Inc.

### **2.02 HVAC IDENTIFICATION MATERIALS**

- A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 23 sections. Where more than single type is specified for application, selections is Installer's option, but provide single selection for each product category.

### **2.03 PLASTIC PIPE MARKERS**

- A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.
- B. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subject to fluid temperatures of 125oF. (52oC) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.
- C. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
  - 1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
  - 2. Laminated or bonded application of pipe marker to pipe (or insulation).
  - 3. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".
- D. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
  - 1. Laminated or bonded application of pipe marker to pipe (or insulation).
  - 2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2" wide; full circle at both ends of pipe marker, taped lapped 3".
  - 3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.
- E. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.
  - 1. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as a separate unit of plastic.

### **2.04 PLASTIC TAPE**

- A. General: Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.
- B. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.
- C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

## **2.05 UNDERGROUND TYPE PLASTIC LINE MARKER**

- A. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates the type of service of buried pipe.
  - 1. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

## **2.06 VALVE TAGS**

- A. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamped-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high and with 5/32" hole for fastener.
  - 1. Provide 1-1/2" diameter tags, except as otherwise indicated.
  - 2. Fill tag engraving with black enamel.
- B. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
- C. Access panel markers: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
- D. Access Panel Markers: Provide manufacturer's standard 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hole to allow attachment.

## **2.07 DIAGRAM AND SCHEDULE FRAMES**

- A. General: For each page of schedule and/or diagrams, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

## **2.08 ENGRAVED PLASTIC LAMINATE SIGNS**

- A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, white with black core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
- B. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.
- C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

## **2.09 LETTERING AND GRAPHICS**

- A. General: Coordinate names, abbreviations and other designations used in HVAC identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of HVAC systems and equipment.
  - 1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

## **2.10 EQUIPMENT MARKERS**

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
  - 1. Data:
    - a. Manufacturer, product name, model number, and serial number.
    - b. Capacity, operating and power characteristics, and essential data.
    - c. Labels of tested compliances.
  - 2. Location: Accessible and visible.
  - 3. Fasteners: As required to mount on equipment.

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- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
  - 1. Terminology: Match schedules as closely as possible.
  - 2. Data.
  - 3. Name and plan number.
    - a. Equipment service.
    - b. Design capacity.
    - c. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
  - 4. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine sub-core, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
  - 1. Data: Instructions for operation of equipment and for safety procedures.
  - 2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
  - 3. Retain and edit subparagraph above or first subparagraph below.
  - 4. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
  - 5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.
- D. Access Panel and Door Markers: 1/16-inch thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
  - 1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

## **2.11 PLASTIC DUCT MARKERS**

- A. Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

## **PART 3 - EXECUTION**

### **3.01 GENERAL INSTALLATION REQUIREMENTS**

- A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finishes, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

### **3.02 PIPING SYSTEM IDENTIFICATION**

- A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
  - 1. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot-non-insulated pipes.
- B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
  - 1. Near each valve and control device.
  - 2. Near each branch; mark each pipe at branch, where there could be question of flow pattern.
  - 3. Near locations where pipes pass through walls, floors ceilings, or enter non-accessible enclosures.
  - 4. At access doors, manholes similar access points which permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment. On piping above removable acoustical ceilings, except omit intermediately

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**3.03 UNDERGROUND PIPING IDENTIFICATION**

- A. General: During back-filling/top-soiling of each exterior underground piping systems, except sanitary sewer and storm drainage install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker.

**3.04 VALVE IDENTIFICATION**

- A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units. List each tagged valve on valve schedule for each piping system.
- B. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect/Engineer.

**3.05 HVAC EQUIPMENT IDENTIFICATION**

- A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of HVAC equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
  - 1. Fuel-burning units including boilers, furnaces, heaters.
  - 2. Pumps, compressors, chillers, condensers and similar motor-driven units.
  - 3. Fans and blowers.
  - 4. Packaged HVAC central-station or zone-type units.
  - 5. Split air conditioner indoor and outdoor units
  - 6. Single Duct terminal units and all equipment in ceiling space.
  - 7. In addition to the equipment tag, install an identification tag for VAV units in locations approved by Architect to indicate where each unit is installed above the ceiling. Coordinate the installation location, type, size and color of this tag with the Architect.
- B. Lettering Size: Minimum 1/4" high lettering for name of unit where viewing distance is less than 2'-0", 1/2" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 of size of the principal lettering.
- C. Test of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

**3.06 ADJUSTING AND CLEANING**

- A. Adjusting: Relocate any HVAC identification device which has become visually blocked by work of this division or other divisions.
- B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

**END OF SECTION**

**SECTION 23 05 93**  
**TESTING, ADJUSTING, AND BALANCING**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives and measurement and reporting of sound and vibration levels. including the following:
  - 1. Balancing airflow and water flow within distribution systems, including sub-mains, branches, and terminals, to indicated quantities according to specified tolerances.
  - 2. Test, adjust and balance hydronic system based on the requirements of the existing variable flow chilled and heating water systems.
  - 3. Adjusting total HVAC systems to provide indicated quantities.
  - 4. Measuring electrical performance of HVAC equipment.
  - 5. Setting quantitative performance of HVAC equipment.
  - 6. Verifying that automatic control devices are functioning properly.
  - 7. Reporting results of the activities and procedures specified in this Section.
- B. Related Sections include the following:
  - 1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
  - 2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

**1.03 DEFINITIONS**

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including sub-mains, branches, and terminals, according to design quantities.
- C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- E. Report Forms: Test data sheets for recording test data in logical order.
- F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- K. Test: A procedure to determine quantitative performance of a system or equipment.
- L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.



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- M. AABC: Associated Air Balance Council.
- N. T&B: Testing, adjusting, and balancing.
- O. T&B Agency: An independent entity certified by AABC to perform testing and balancing work.
- P. TBE: AABC certified test and balance engineer.
- Q. TBT: AABC certified test and balance technician.
- R. HVAC: Heating, ventilating, and air conditioning.
- S. BAS: Building automation systems.
- T. Contract documents: the mechanical drawings and test and balance specification.
- U. NC: noise criteria.
- V. RC: room criteria.
- W. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

**1.04 SUBMITTALS**

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation T&B of AABC certification of T&B agency and personnel, including a sample copy of the AABC "National Performance Guaranty." If not submitted within the timeframe specified, the engineer has the right to choose an AABC agency at the Contractor's expense.
- B. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit T&B strategies and step-by-step procedures as specified in "Preparation" Article. Include a complete set of report forms intended for use on this Project.
- C. System Readiness Checklists: Within 60 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article to be used and filled out by systems Installers verifying that systems are ready for T&B.
- D. Examination Report: Within 60 days of Contractor's Notice to Proceed, provide a summary report of the examination review required in Part 3 "Examination", if issues are discovered that may preclude the proper testing and balancing of the systems.
- E. Certified T&B reports: Within 14 days of completion of balancing work, submit AABC-Certified T&B report.
  - 1. Submit one copy of the final T&B Report directly to the design professional of record. Provide five additional copies to the contractor.
- F. Warranty: Submit 6 copies of special warranty specified in the "Warranty" Article below.
- G. Provide a summary of any discrepancies found in the system, by Air balance contractor to each system as described hereafter. Include a complete list of deficiencies and problems found in system being tested and balanced. Add this report to final submittal package.

**1.05 QUALITY ASSURANCE**

- A. T&B Agency Qualifications: Engage a T&B entity certified by AABC.
  - 1. T&B Field Supervisor: Employee of the T&B Agency who is certified by AABC.
  - 2. T&B Technician: Employee of the T&B Agency and who is certified by AABC as a TBT.
- B. Testing, Adjusting, and Balancing Conference: Meet with the Owner's and the Architect's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days' advance notice of scheduled meeting time and location.
  - 1. Agenda Items: Include at least the following:
    - a. Submittal distribution requirements.
    - b. Contract Documents examination report.
    - c. Testing, adjusting, and balancing plan.
    - d. Work schedule and Project site access requirements.

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- e. Systems readiness checklists.
  - f. Coordination and cooperation of trades and subcontractors.
  - g. Coordination of documentation and communication flow.
- C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:
- 1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
  - 2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.
- D. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC "National Standards for Testing, Adjusting, and Balancing."
- E. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards.
- F. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

**1.06 PROJECT CONDITIONS**

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire T&B period. Cooperate with Owner during T&B operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during T&B operations to minimize conflicts with Owner's operations.

**1.07 COORDINATION**

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.
- B. Notice: Provide 7 days advance notice for each test. Include scheduled test dates and times.
- C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.
- D. Review Division 23 contract documents to assure that the design has considered all required components necessary for a complete and successful testing, adjusting and balancing of the system as described hereafter. Prepare a report for this examination of contract documents and propose any additional components required to complete the scope of work this section no later than 45 days after the award of the contract.

**1.08 WARRANTY**

- A. General Warranty: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. National Project Performance Guarantee: Provide a guarantee on AABC "National Standards" forms stating that AABC will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:
  - 1. The certified Agent has tested and balanced systems according to the Contract Documents.
  - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

**PART 2 - PRODUCTS (Not Applicable)**

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.
  - 1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers.
  - 1. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation. Note the locations of devices that are not accessible for testing and balancing.
- C. Examine approved submittal data of HVAC systems and equipment.
- D. Examine project record documents described in Division 01 Section "Project Record Documents."
- E. Examine ceiling plenums and under-floor air plenums used for supply, return, or relief air to verify that are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, clean permanent filters are installed, and equipment with functioning controls is ready for operation.
- G. Examine Architect's and Engineer's design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- H. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
- I. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
- J. Examine system and equipment test reports.
- K. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- L. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- M. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- N. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected, configured by the controls contractor, and functioning.
- O. Examine strainers to verify that mechanical contractor has replaced startup screens with permanent screens and that all strainers have been cleaned.
- P. Examine 2-Way valves for proper installation for their intended function.

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- Q. Examine 3-Way valves for proper installation for their intended function of diverting or mixing fluid flows.
- R. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- S. Examine air vents to verify that mechanical contractor has removed all air from all hydronic systems.
- T. Examine equipment for installation and for properly operating safety interlocks and controls.
- U. Prior to examination of the vibration isolation system, verify that all system and equipment installations are complete and that testing, adjusting, and balancing specified in the contract documents have been performed.
- V. Examine all vibration Isolation system. All vibration isolated equipment and piping must be inspected and examined before startup and shall include the following:
  - 1. Verify that all isolators are installed in accordance with manufacturer's recommendations.
  - 2. Verify that piping, duct, and conduit penetrations through mechanical equipment room envelope are sealed, and if required, rigid contact with building structure does not exist.
  - 3. Steel isolation bases must be inspected for cracked welds, excessive bending or twisting of steel members.
  - 4. Concrete isolation bases must be examined for cracked concrete. Isolator retainer brackets must be checked for looseness. The concrete base must be flat and true in plane.
  - 5. Elastomer isolators must be examined for cracks in the rubber and for loose bonds between the rubber and steel plates or other steel components. Adequate clearance must be provided between bolts and the side of the bolt holes to prevent short circuiting.
  - 6. Steel spring isolators must be examined for loose or missing bolts, nuts or lock washers. Check for spring overloading or under-loading, completely collapsed spring coils, and cocked springs. Note if rubber or glass fiber pad between the bottom plate of the steel spring and the concrete slab or supporting structure is present.
  - 7. Housed steel springs must be examined for proper centering of the springs, clearance between the cast housing and rubber snubber, and the steel spring for tilted or cocked springs.
  - 8. When the specifications require that the isolators be bolted to the concrete slab or other supporting structure, the bolts may be isolated by means of rubber bushings and rubber washers.
  - 9. Inspect isolators with restraint devices to make sure that all shims have been removed and supportive nuts have been properly adjusted to allow for free floating of the isolated system.
  - 10. Seismic restraints shall not prevent the proper functioning of vibration isolation system.
  - 11. Pneumatic isolators must be inspected for overload or under-load by checking the air pressure gauge against manufacturer's submittals or catalog. The pneumatic isolator system should include the isolator, strainer, oil separator, height regulator, and air pressure gauge. Inspect the vicinity of the isolator. Note if the isolator is exposed to damage from vehicle or other traffic.
  - 12. Carefully inspect the space under all isolated bases to assure that these spaces are clean and free of debris to prevent short-circuiting.
  - 13. Check to ensure that all shipping bolts associated with spring isolators have been removed.
  - 14. Inspect all flexible piping, hoses, and expansion joints as to type, length and location as called for by the specifications. Examine flexible hose for excessive elongation.
  - 15. Inspect all electrical and control connections to ensure that they do not restrain the movement of the vibration isolated equipment.
  - 16. Inspect all fabric connections between fans and ductwork to ensure that a fabric "bellows" exists when the fans are operating.

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17. Each piece of vibration isolated machinery must be free of any structural tie or rigid connection that may "short circuit" the isolation system. All limit stops, shipping bolts, and leveling bolts on all isolators must be inspected to ensure that they are not "short circuiting" the isolation system.
  18. Hanger isolators should be free of misalignment and over / under-loading. Under no circumstances the isolator rod should be allowed to make rigid contact with the hanger housing.
  19. Report deficiencies as discovered to the appropriate parties.
- W. Examine automatic temperature system components to verify the following:
1. Dampers, valves, and other controlled devices operate by the intended controller.
  2. Dampers and valves are in the position indicated by the controller.
  3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multi-zone units, mixing boxes, and variable-air-volume terminals.
  4. Automatic modulating and shutoff valves, including 2-way valves, are properly connected.
  5. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
  6. Sensors are located to sense only the intended conditions.
  7. Sequence of operation for control modes is according to the Contract Documents.
  8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
  9. Interlocked systems are operating.
  10. Changeover from heating to cooling mode occurs according to design values.
- X. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

### 3.02 PREPARATION

- A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures that includes the following:
1. Equipment and systems to be tested.
  2. Strategies and step-by-step procedures for balancing the systems.
  3. Instrumentation to be used.
  4. Sample forms with specific identification for all equipment.
- B. Prepare system-readiness checklists, as described in the "AABC National Standards for Total System Balance," for use by systems installers in verifying system readiness for T&B. These shall include, at a minimum, the following:
1. Airside:
    - a. Ductwork is complete with terminals installed.
    - b. Volume, smoke and fire dampers are open and functional.
    - c. Clean filters are installed.
    - d. Fans are operating, free of vibration, and rotating in correct direction.
    - e. Variable-frequency controllers' start-up is complete and safeties are verified.
    - f. Automatic temperature-control systems are operational.
    - g. Ceilings are installed.
    - h. Windows and doors are installed.
    - i. Suitable access to balancing devices and equipment is provided.
  2. General
    - a. Permanent electrical power wiring is complete.
    - b. Equipment and duct access doors are securely closed.

### 3.03 GENERAL TESTING AND BALANCING PROCEDURES

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC "National Standards for Total System Balance" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for T&B procedures.

- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

### **3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS**

- A. Prepare test reports for both fans and outlets. Obtain approved submittals and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare single-line schematic diagram of systems "as-built" for the purpose of identifying HVAC components.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check condensate drains for proper connections and functioning.
- H. Check for proper sealing of air-handling-unit components.
- I. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- J. Check dampers for proper position to achieve desired airflow path.
- K. Check for airflow blockages.

### **3.05 PROCEDURES FOR CONSTANT VOLUME AIR SYSTEMS**

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure total airflow.
    - a. Set outside air, return air and relief air dampers for proper position that simulates minimum outdoor air conditions.
    - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
    - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
    - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
  - 2. Measure fan static pressures as follows:
    - a. Measure static pressure directly at the fan outlet or through the flexible connection.
    - b. Measure static pressure directly at the fan inlet or through the flexible connection.
    - c. Measure static pressure across each component that makes up the air-handling system.
    - d. Report any artificial loading of filters at the time static pressures are measured.
  - 3. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, sub-main ducts, and major branch ducts to indicated airflows.
  - 1. Measure airflow of sub-main and branch ducts.
  - 2. Adjust sub-main and branch duct volume dampers for specified airflow.  
Re-measure each sub-main and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.

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1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
  2. Measure airflow at all inlets and outlets.
  3. Adjust each inlet and outlet for specified airflow.
  4. Re-measure each inlet and outlet after all have been adjusted.
- D. Verify final system conditions.
1. Re-measure and confirm minimum outdoor air, return and relief airflows are within design. Readjust to design if necessary.
  2. Re-measure and confirm total airflow is within design.
  3. Re-measure all final fan operating data, RPM, Volts, Amps, static profile.
  4. Mark all final settings.
  5. Test system in economizer mode. Verify proper operation and adjust, if necessary.
  6. Measure and record all operating data.
  7. Record final fan performance data.

### **3.06 TEMPERATURE TESTING**

- A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature control system.
- B. Measure indoor wet-bulb and dry-bulb temperatures every other hour for a period of 2 successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside air wet-bulb and dry-bulb temperatures.

### **3.07 PROCEDURES FOR VIBRATION MEASUREMENTS**

- A. Perform vibration measurements when other building and outdoor vibration sources are at a minimum level and will not influence measurements of equipment being tested.
  1. Turn off equipment in the building that might interfere with testing.
  2. Restrict people from occupying areas where human activity may affect accuracy of measurements.
  3. Note all exterior vibration sources; i.e. trains, roadway traffic, adjacent construction activities, etc.
- B. Attach and secure the vibration transducer in accordance with the latest edition of the AABC S&V Procedural Standards for Measurement of Sound and Vibration.
- C. Measure and record, on all pumps and fans over 3 HP, and all chillers and compressors over 5 HP, at discrete frequencies or in 1/3 octave bands as follows:
  1. Discrete vibration levels from 1 to 200 Hz in 1 Hz increments, or
  2. In each 1/3 octave band from 12.5 Hz to 100 Hz.
- D. Measure and record equipment vibration, bearing vibration, equipment base vibration, and on building structure adjacent to equipment. Record velocity and displacement readings in the radial vertical, radial horizontal and axial planes, where measurements can be performed safely.
  1. Fans and HVAC Equipment with Fans:
    - a. Fan Bearing: Drive end and opposite end.
    - b. Motor Bearing: Drive end and opposite end.
    - c. Equipment Base: Top and side, within 6" of each isolator.
    - d. Building: Floor adjacent to fan/motor, within 6" of each isolator.
  2. Chillers and HVAC Equipment with Compressors:
    - a. Compressor Bearing: Drive end and opposite end.
    - b. Motor Bearing: Drive end and opposite end.
    - c. Equipment Base: Top and side, within 6" of each isolator.
    - d. Building: Floor adjacent to equipment, within 6" of each isolator.
- E. Vibration Measurement Reports:
  1. Date and time of test
  2. Equipment designation, location, equipment speed, motor speed and motor horsepower.

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3. Measured acceleration (in units of g's, inches/sec<sup>2</sup>), and measured velocity (in units of inches/sec) and measured displacement (in units of inches).

**3.08 PROCEDURES FOR SOUND LEVEL MEASUREMENTS**

- A. Close windows and doors to the space.
- B. Perform measurements when the space is not occupied, or when the occupant noise levels from other spaces in the building and outside are at a minimum, or do not affect sound readings.
- C. Clear the space of temporary sound sources so unrelated disturbances will not be measured. Turn off all sound sources (personal computers, printers, fax machines, etc) in the space that may affect sound readings.
- D. Position testing personnel during measurements to achieve a direct line-of-sight between the sound source and the sound-level meter.
- E. Take sound measurements at a height approximately 48 inches above the floor and at least 36 inches from a wall, column, or any other large surface capable of altering the measurements.
- F. Take sound measurements in dB (linear or flat), with the slow time constant, in the octave bands from 31.5 to 8000 Hz.
- G. Take sound measurements with the HVAC systems off to establish the background levels and take sound measurements with the HVAC systems operating. Calculate the difference between measurements. Apply a correction factor depending on the difference and adjust measurements.
- H. Perform sound testing in all occupied space horizontally and vertically adjacent to all mechanical equipment rooms and all mechanical chases.
- I. Perform sound testing at 10% of locations on the project for each type of the following spaces. For each space type tested, select a measurement location that has the greatest anticipated sound level. If testing multiple locations for each space type, select at least one location that is near and at least one location that is remote from the predominant sound source.
  1. Private office.
  2. Open office area.
  3. Conference room.
  4. Auditorium/large meeting room/lecture hall.
  5. Classroom/training room.
  6. Library open space.
  7. Public areas (such as, lobbies, hallways, break rooms).
  8. Perform sound testing in all spaces with a design criterion of NC or RC 25 or less.
- J. Sound Measurement Reports: Record sound measurements on appropriate test forms, indicating the decibel levels measured in for both "background" and "HVAC system operating" readings. Record each tested location on a separate NC or RC chart. Record the following on the forms.
  1. Date and time of test.
  2. Equipment operational parameters – speed / frequency at time of measurements.
  3. Indoor measurements - space location within building including floor level and room /space number.
  4. Outdoor measurements – location identifier such as location relative to equipment, building, or property line.
  5. Indicate where measurements meet or exceed design criteria

**3.09 CONTROL VERIFICATION**

- A. In conjunction with system balancing perform the following:
  1. Work with the temperature control contractor to ensure the system is operating within the design limitations, and gain a mutual understanding of intended control performance.



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2. Confirm that the sequences of operation are in compliance with the approved drawings. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.
  3. Verify that controllers are calibrated and function as intended.
  4. Verify that controller set-points are as specified.
  5. Verify operation of limiting controllers (i.e., high and low temperature controllers).
  6. Verify the operation of lockout or interlock systems.
  7. Verify the operation of all valve and damper actuators.
  8. Verify that all controlled devices are properly installed and connected to the correct controller.
  9. Verify that all controlled devices travel freely and are in the position indicated by the controller: open, closed, or modulating.
  10. Verify the location and installation of all sensors to ensure they will sense only the intended temperatures, humidity, or pressures. Note conditions that would adversely affect control functions.
  11. Record controller settings and note variances between set points and actual measurements.
  12. Confirm interaction of electrically operated switch transducers.
  13. Verify main control supply-air pressure and observe compressor and dryer operations.
  14. Record voltages of power supply and controller output. Determine if the system operates on a grounded or non-grounded power supply.
  15. Note operation of electric actuators using spring return for proper fail-safe operations.
- B. Reporting
1. The report shall include a summary of verifications performed, remaining deficiencies, and any variations from specified conditions.

### 3.10 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans: Minus 10 to plus 10 percent.
  2. Fresh air intake: 0 to plus 5%.
  3. Air Outlets and Inlets: Minus 10 to plus 10 percent.
  4. Heating-Water Flow Rate: Minus 5 to plus 5 percent.
  5. Cooling-Water Flow Rate: Minus 5 to plus 5 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

### 3.11 REPORTING

- A. Initial Construction Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

### 3.12 FINAL REPORT

- A. General: Computer printout in letter-quality font, on standard bond paper, in a fine quality 3-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. The final report for sound and vibration measurement shall be in accordance with the requirements of the current edition of the AABC Procedural Standards for Measurement of Sound and Vibration.

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- C. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
  - 1. Include a list of the instruments used for procedures, along with proof of calibration.
- D. Final Report Contents: In addition to the certified field report data, include the following:
  - 1. Fan curves.
  - 2. Manufacturers' test data.
  - 3. Field test reports prepared by system and equipment installers.
  - 4. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.
- E. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
  - 1. Title page.
  - 2. Name and address of testing, adjusting, and balancing Agent.
  - 3. Project name.
  - 4. Project location.
  - 5. Architect's name and address.
  - 6. Engineer's name and address.
  - 7. Contractor's name and address and field technician responsible for the project.
  - 8. Report date.
  - 9. Signature of testing, adjusting, and balancing Agent who certifies the report.
  - 10. Summary of contents, including the following:
    - a. Design versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  - 11. Nomenclature sheets for each item of equipment.
  - 12. Data for terminal units, including manufacturer, type size, and fittings.
  - 13. Notes to explain why certain final data in the body of reports vary from design values.
  - 14. Test conditions for fans and pump performance forms, including the following:
    - a. Settings for outside-air, return-air, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet-bulb and dry-bulb conditions.
    - d. Face and bypass damper settings at coils.
    - e. Fan drive settings, including settings and percentage of maximum pitch diameter.
    - f. Inlet vane settings for variable-air-volume systems.
    - g. Settings for supply-air, static-pressure controller.
    - h. Other system operating conditions that affect performance.
- F. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:
  - 1. Quantities of outside, supply, return, and exhaust airflows.
  - 2. Water and steam flow rates.
  - 3. Duct, outlet, and inlet sizes.
  - 4. Pipe and valve sizes and locations.
  - 5. Balancing stations.
- G. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
  - 1. Unit Data: Include the following:
    - a. Unit identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Unit arrangement and class.
    - g. Discharge arrangement.
    - h. Sheave make, size in inches, and bore.

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- i. Sheave dimensions, center-to-center and amount of adjustments in inches.
  - j. Number of belts, make, and size.
  - k. Number of filters, type, and size.
- 2. Motor Data: Include the following:
  - a. Make and frame type and size.
  - b. Horsepower and RPM.
  - c. Volts, Phase, and Hertz.
  - d. Full-load amperage and service factor.
  - e. Sheave make, size in inches, and bore.
  - f. Sheave dimensions, center-to-center and amount of adjustments in inches.
- 3. Test Data: Include design and actual values for the following:
  - a. Total airflow rate in CFM.
  - b. Total system static pressure in Inches W.G.
  - c. Fan RPM.
  - d. Discharge static pressure in Inches W.G.
  - e. Filter static-pressure differential in Inches W.G.
  - f. Preheat coil static-pressure differential in Inches W.G.
  - g. Cooling coil static-pressure differential in Inches W.G.
  - h. Heating coil static-pressure differential in Inches W.G.
  - i. Outside airflow in CFM.
  - j. Return airflow in CFM.
  - k. Outside-air damper position.
  - l. Return-air damper position.
  - m. Vortex damper position.
- H. Apparatus-Coil Test Reports: For apparatus coils, include the following:
  - 1. Coil Data: Include the following:
    - a. System identification.
    - b. Location.
    - c. Coil type.
    - d. Number of rows.
    - e. Fin spacing in fins per inch.
    - f. Make and model number.
    - g. Face area in Sq. Ft.
    - h. Tube size in NPS.
    - i. Tube and fin materials.
    - j. Circuiting arrangement.
  - 2. Test Data: Include design and actual values for the following:
    - a. Airflow rate in CFM.
    - b. Average face velocity in FPM.
    - c. Air pressure drop in Inches W.G.
    - d. Outside-air, wet- and dry-bulb temperatures in deg. F.
    - e. Return-air, wet- and dry-bulb temperatures in deg. F.
    - f. Entering-air, wet- and dry-bulb temperatures in deg. F.
    - g. Leaving-air, wet- and dry-bulb temperatures in deg. F.
    - h. Water flow rate in GPM.
    - i. Water pressure differential in Feet of Head or PSIG.
    - j. Entering-water temperature in deg. F.
    - k. Leaving-water temperature in deg. F.
    - l. Refrigerant expansion valve and refrigerant types.
    - m. Refrigerant suction pressure in PSIG.
    - n. Refrigerant suction temperature in deg. F.
    - o. Inlet steam pressure in PSIG.
- I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

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1. Fan Data: Include the following:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
    - g. Sheave make, size in inches, and bore.
    - h. Sheave dimensions, center-to-center and amount of adjustments in inches.
  2. Motor Data: Include the following:
    - a. Make and frame type and size.
    - b. Horsepower and RPM.
    - c. Volts, Phase, and Hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Sheave dimensions, center-to-center and amount of adjustments in inches.
    - g. Number of belts, make, and size.
  3. Test Data: Include design and actual values for the following:
    - a. Total airflow rate in CFM.
    - b. Total system static pressure in Inches W.G.
    - c. Fan RPM.
    - d. Discharge static pressure in Inches W.G.
    - e. Suction static pressure in Inches W.G.
- J. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data: Include the following:
    - a. System and air-handling unit number.
    - b. Location and zone.
    - c. Traverse air temperature in deg. F.
    - d. Duct static pressure in Inches W.G.
    - e. Duct size in Inches.
    - f. Duct area in Sq. Ft.
    - g. Design airflow rate in CFM.
    - h. Design velocity in FPM.
    - i. Actual airflow rate in CFM.
    - j. Actual average velocity in FPM.
    - k. Barometric pressure in PSIG.
- K. Air-Terminal-Device Reports: For terminal units, include the following:
1. Unit Data: Include the following:
    - a. System and air-handling unit identification.
    - b. Location and zone.
    - c. Test apparatus used.
    - d. Area served.
    - e. Air-terminal-device manufacturer.
    - f. Air-terminal-device number from system diagram.
    - g. Air-terminal-device type and model number.
    - h. Air-terminal-device size.
    - i. Air-terminal-device effective area in Sq. Ft.
  2. Test Data: Include design and actual values for the following:
    - a. Airflow rate in CFM.
    - b. Air velocity in FPM.
    - c. Preliminary airflow rate as needed in CFM.
    - d. Preliminary velocity as needed in FPM.

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- e. Final airflow rate in CFM.
- f. Final velocity in FPM.
- g. Space temperature in deg. F.
- L. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
  - 1. Unit Data: Include the following:
    - a. System and air-handling unit identification.
    - b. Location and zone.
    - c. Room or riser served.
    - d. Coil make and size.
    - e. Flow-meter type.
  - 2. Test Data: Include design and actual values for the following:
    - a. Airflow rate in CFM.
    - b. Entering-water temperature in deg. F.
    - c. Leaving-water temperature in deg. F.
    - d. Water pressure drop in Feet of Head or PSIG.
    - e. Entering-air temperature in deg. F.
    - f. Leaving-air temperature in deg. F.
- M. Instrument Calibration Reports: For instrument calibration, include the following:
  - 1. Report Data: Include the following:
    - a. Instrument type and make.
    - b. Serial number.
    - c. Application.
    - d. Dates of use.
    - e. Dates of calibration.

**3.13 ADDITIONAL TESTS**

- A. Within 90 days of completing testing, adjusting, and balancing. Perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.
- C. Duct Leakage Testing:
  - 1. Perform duct pressure/leakage testing on newly constructed ductwork.
  - 2. Verify that proper test methods are used and that leakage rates are within specified tolerances per section 233113.
  - 3. Report any deficiencies observed.

**END OF SECTION**

**SECTION 23 07 00**  
**HVAC INSULATION**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Extent of HVAC insulation required by this section is indicated on drawings and schedules, and by requirements of this section, and includes the following:
  - 1. Piping Systems Insulation:
    - a. Fiberglass.
    - b. Calcium Silicate.
    - c. Flexible Unicellular.
  - 2. Ductwork System Insulation:
    - a. Fiberglass
    - b. Flexible Unicellular.
  - 3. Equipment Insulation:
    - a. Fiberglass
    - b. Calcium Silicate
    - c. Flexible Unicellular.
  - 4. Acoustical Insulation:
    - a. Fiberglass

**1.02 RELATED SECTIONS**

- A. Refer to Division 23 Section "Supports and Anchors" for protection saddles, protection shields, and thermal hanger shields; not work of this section.
- B. Refer to Division 23 Section "HVAC Identification" for installation of identification devices for piping, ductwork, and equipment; not work of this section.

**1.03 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of HVAC insulation. Submit schedule showing manufacturer's product number, K-value, thickness, and furnished accessories for each HVAC system requiring insulation.
- B. Maintenance Data: Submit maintenance data and replacement material lists for each type of HVAC insulation. Include this data and product data in maintenance manual.

**1.04 QUALITY ASSURANCE**

- A. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.
- B. As a minimum, insulation shall meet installed conductance as set forth in Title 24 California Code of Regulations (CCR) 2019 Building Energy Efficiency Standards or as indicated in contract documents, whichever is greater.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
- B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

**PART 2 - PRODUCTS**

**2.01 ACCEPTABLE MANUFACTURERS**

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
  - 1. Owens-Corning Fiberglas Corp.
  - 2. Manville Products Corp.

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3. CertainTeed Corp.
4. Armstrong World Industries, Inc.
5. Knauf Fiber Glass GmbH.

**2.02 PIPING INSULATION MATERIALS**

- A. Fiberglass (Mineral Fiber) Piping Insulation: ASTM C547, Class 1 unless otherwise indicated. Manville Products Corp. Micro-Lok, Owens-Corning Fiberglas Corp., ASJ/SL-II or equivalent.
- B. Calcium Silicate Piping Insulation: ASTM C533, Type I. Owens-Corning Fiberglass Corp. "Kaylo Asbestos Free" or equivalent.
- C. Flexible Unicellular Piping Insulation: ASTM C534, Type I. Armstrong World Industries, Inc. meeting ASTM E-84 25/50 index.
- D. Jackets for Piping Insulation: ASTM C921, Type I (Vapor Barrier) for piping with temperatures below ambient. (Type II (Water Vapor Permeable) for piping with temperatures above ambient. Type I may be used for all piping at Installer's option.
  1. Encase pipe fittings insulation with one-piece pre-molded PVC fitting covers, fastened as per manufacturer's recommendations. Zeston PVC Insulated fitting covers or equivalent.
  2. Encase exterior piping insulation with aluminum jacket with weather-proof construction.
- E. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.
- F. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.
- G. All Insulation shall be U.L. listed showing flame spread not greater than 25, nor smoke greater than 50, per NFPA 90A.

**2.03 DUCTWORK INSULATION MATERIALS**

- A. Flexible Fiberglass Ductwork Insulation: ASTM C553, Type I, Class B-2, Owens-Corning Fiberglas Inc. un-faced duct wrap insulation, Type 100 or equivalent.
  1. Nominal thickness or equivalent to provide installed R-value as follows:
    - a. 1.5" thick - Installed R = 4.2
    - b. 2.0" thick - Installed R = 5.6
- B. Flexible Fiberglass Ductwork Insulation: ASTM C612, with ASTM C921 Type I vapor barrier jacket. Owens/Corning Fiberglas All Service Wrap Insulation, Type 100 or equivalent:
  1. Nominal thickness or equivalent to provide an installed R-value as follows:
    - a. 1.5" thick - Installed R = 4.2
    - b. 2.0" thick - Installed R = 5.6
- C. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.
- D. Rooftop ductwork and ductwork that are not in conditioned space or indirectly conditioned spaces are to be insulated with material to achieve minimum installed R value equal to 8.0 to meet the 2019 Building Energy Efficiency Standards. For double wall rooftop ductwork see HVAC drawings.
- E. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.
- F. All Insulation shall be U.L. listed showing flame spread not greater than 25, nor smoke greater than 50, per NFPA 90A.

**2.04 EQUIPMENT INSULATION MATERIALS**

- A. Flexible Fiberglass Equipment Insulation: ASTM C553, Type II, Class F-1, Owens-Corning Fiberglass, Inc., Type 701 1.5 lbs/Ft3.
- B. Calcium Silicate Equipment Insulation: ASTM C533, Type I, Block; Owens/Corning Fiberglass, Inc., Kaylo Asbestos Free, U-Grooved block insulation.

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- C. Jacketing Material for Equipment Insulation: Provide canvas jacketing material, not less than 7.8 ounces per square yard, or metal jacket at Installer's option, except as otherwise indicated.
- D. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.
- E. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape corner angles, anchors and stud piping as recommended by insulation manufacturer for applications indicated.
- F. All Insulation shall be U.L. listed showing flame spread not greater than 25, nor smoke greater than 50, per NFPA 90A.

**2.05 ACOUSTICAL INSULATION**

- A. Rigid Fiberglass Insulation: ASTM C612, Class 1, Owens/Corning Fiberglass, Inc., 10 Lbs/Cu. Ft.

**PART 3 - EXECUTION**

**3.01 INSPECTION**

- A. Examine areas and conditions under which HVAC insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

**3.02 HVAC PIPING SYSTEM INSULATION**

- A. Insulation Omitted: Omit insulation on the following:
  - 1. Hot piping within radiation enclosures
  - 2. Hot unions, flanges, strainers, flexible connections and expansion joints.
- B. Cold Piping (40°F to ambient):
  - 1. Application Requirements: Insulate the following cold HVAC piping systems:
    - a. HVAC chilled water supply and return piping.
    - b. Air conditioner condensate drains piping.
  - 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
    - a. Fiberglass: 1" thick for pipe sizes up to and including 4", 1-1/2" thick for pipe sizes over 4".
    - b. Flexible Unicellular: 1/2" thick for pipe sizes up to 1-1/2" (A.C. condensate piping only).
- C. Hot Low Pressure Piping (to 250°F):
  - 1. Application Requirements: Insulate the following hot low pressure HVAC piping systems (steam piping up to 15 psi, water piping up to 250°F (121°C)).
    - a. HVAC heating water supply and return piping.
  - 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
    - a. Fiberglass: 1" thick for pipe sizes up to and including 1", 1-1/2" thick for pipe sizes 1-1/2"; 2" thick for piping over 2".

**3.03 DUCTWORK SYSTEM INSULATION**

- A. Insulation Omitted:
  - 1. Do not insulate outside air and exhaust air ductwork unless otherwise indicated.
  - 2. Do not insulate exhaust air ductwork unless otherwise indicated.
  - 3. All ductwork specified to be insulated that is located in mechanical rooms, located on roofs, or where exposed in conditioned spaces or to weather shall be internally lined under Section 233113 "Metal Ductwork"; unless noted otherwise in these specifications or on the drawings.
- B. Insulate the following with flexible fiberglass insulation, un-faced, 1.5" thickness unless otherwise noted. Firmly wrap insulation around duct work with all joints lapped a minimum of 2 inches. Secure insulation to ducts by means of 16 gauge soft-annealed galvanized wire spaced 12 inches on centers at loose ends.



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1. Warm air heating ductwork in concealed spaces, unless in ceiling plenum provide all service wrap insulation.
  2. Return air ductwork in non-conditioned concealed spaces unless in ceiling supply plenum uses all service wrap insulation.
  3. Return air ductwork located in return air ceiling plenums outside air ductwork supplying fan coil units.
- C. Insulate the following with Flexible Fiberglass insulation with all service vapor barrier facing, 1.5" thickness unless noted otherwise.
1. HVAC hot/cold mixed air ductwork between fan discharge or HVAC unit discharge, and room terminal unit.
  2. Outdoor air intake ductwork between air entrance and indoor fan inlet or indoor HVAC unit inlet.
  3. Installation:
    - a. Neatly wrap insulation around ducts with all joints tightly butted together.
    - b. Seal transverse joints with vapor barrier facing tab overlapping all joints 2-inches and secure with vapor barrier adhesive or outward-clinch staples on 4-inches centers.
    - c. Seal longitudinal joints with 4-inch wide vapor barrier adhesive tape.
    - d. Secure insulation to underside of ducts, 100 percent coverage, with ductwork insulation adhesive.
    - e. In addition to adhesive, on underside of ducts 24-inches or greater in width, use mechanical fasteners on maximum 12-inch centers.
    - f. Seal all penetrations of vapor barrier facing with vapor barrier mastic.
- D. Insulate the following with Rigid Fiberglass Insulation, 2.0" thickness unless noted otherwise.
1. HVAC and unit housings not pre-insulated at the factory or where lining has been specifically omitted.
  2. Installation: Fasten to ductwork with adhesive and pins per manufacturer's recommendations. Provide all Butt-joints with a 16 gage corner angles at corners. Seal all joints with approved duct tape.
- E. Contractor's Option: Contractor may provide duct liner as set forth in Section 233113, using equivalent installed "R" values; in lieu of external duct wrap or rigid insulation as specified above unless ductwork is specifically indicated as being unlined.
- F. Hot Ductwork:
1. Application Requirements: Insulate range and hood exhaust ductwork with PABCO "Super Fire Temp" asbestos free, non-combustible fireproofing board.
    - a. Provide 1 to 4 hour fire rating as indicated.
    - b. Install per manufacturer's instructions.

**3.04 EQUIPMENT INSULATION**

- A. Cold Equipment (Below Ambient Temperature):
1. Application requirements: Insulate the following cold equipment:
    - a. Refrigeration equipment, including chillers, tanks and pumps.
    - b. Drip pans under chilled equipment.
    - c. Cold and chilled water pumps.
    - d. Pneumatic water tanks.
  2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:
    - a. Fiberglass: 2" thick for cold surfaces above 35°F and 3" thick for surfaces 35°F and lower.
- B. Hot Equipment (Above Ambient Temperature):
1. Application Requirements: Insulate the following hot equipment:
    - a. Boilers (not pre-insulated at factory).
    - b. Water heaters.
    - c. Hot water expansion tanks.

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- d. Hot water pumps.
- 2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation.
  - a. Fiberglass: 2" thick, except 3" thick for low-pressure boilers and steam-jacketed heat exchangers.
- C. Breeching and Stacks:
  - 1. Application Requirements: Insulate the following breechings and stacks:
    - a. Breechings between heating equipment outlet and stack or chimney connection, except for double wall or factory insulated breechings.

**3.05 INSTALLATION OF PIPING INSULATION**

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.
- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.
- E. Maintain integrity of vapor barrier jackets on pipe insulation, and protect to prevent puncture or other damage.
- F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
- G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.

**3.06 INSTALLATION OF DUCTWORK INSULATION**

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation materials with smooth and even surfaces.
- C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- D. Maintain integrity of vapor barrier on ductwork insulation, and protect it to prevent puncture and other damage.
- E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.
- F. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed.
- G. Ductwork Exposed to Weather: Where external insulation has been specifically indicated, protect outdoor insulation from weather by installing outdoor protective finish or jacketing as recommended by manufacturer.
- H. Corner Angles: Except for oven and hood exhaust duct insulation, install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

### **3.07 INSTALLATION OF EQUIPMENT INSULATION**

- A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.
- B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.
- C. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.
- D. Do not apply insulation to equipment, breechings, or stacks while hot.
- E. Apply insulation using the staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.
- F. Coat insulated surfaces with layer of insulating cement, trowel in workmanlike manner, leaving a smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.
- G. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable.
- H. Do not insulate boiler manholes, hand-holes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.
- I. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.
- J. Equipment exposed to Weather: Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by the manufacturer.

### **3.08 ACOUSTICAL INSTALLATION**

- A. Install within confines of roof curbs for roof mounted air handlers and air conditioning units, and elsewhere as indicated on drawings
- B. Cut to fit snugly within curb and around duct at duct penetrations, 4" minimum thickness.

### **3.09 PROTECTION AND REPLACEMENT**

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

### **END OF SECTION**

**SECTION 23 31 13**  
**METAL DUCTWORK**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Rectangular and round metal ducts and plenums for heating, ventilating, and air conditioning system from minus 2" to plus 5" Water Gage.

**1.02 RELATED SECTIONS**

- A. Refer to other Division 23 Sections for exterior insulation of metal ductwork; not work of this section.
- B. Refer to other Division 23 Sections for ductwork accessories; not work of this section.
- C. Refer to other Division 23 Sections for fans and air handling units; not work of this section.
- D. Refer to other Division 23 Sections for testing, adjusting and balancing of metal ductwork systems; not work of this section.

**1.03 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data and installation instructions for metal ductwork materials and products.
- B. Record Drawings: At project closeout, submit record drawings of installed metal ductwork and ductwork products, in accordance with requirements of Division 01.
- C. Maintenance Data: Submit maintenance data and parts lists for metal ductwork materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual in accordance with requirements of Division 01.

**1.04 QUALITY ASSURANCE**

- A. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.
- B. Codes and Standards:
  - 1. SMACNA Standards: Comply with SMACNA "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.
  - 2. ASHRAE Standards: Comply with ASHRAE Handbook, Equipment Volume, Chapter 1 "Duct Construction", for fabrication and installation of metal ductwork.
  - 3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."
- C. Field Reference Manual: Have available for reference at project field office, copy of SMACNA "HVAC Duct Construction Standards, Metal and Flexible."

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.
- B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

**PART 2 - PRODUCTS**

**2.01 DUCTWORK MATERIALS**

- A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.

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- B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A653/A653M, lock forming quality, with G90 zinc coating in accordance with ASTM A653/A653M; and mill phosphatized for exposed locations.

**2.02 MISCELLANEOUS DUCTWORK MATERIALS**

- A. General: Provide miscellaneous materials and products of types and sizes indicated or, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.
- B. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 18-degree change of direction per section. Unless specifically detailed otherwise, use 45-degree laterals and 45-degree elbows for branch takeoff connections. Where 90-degree branches are indicated, provide conical type tees.
- C. Screws and bolts shall be cadmium plated.
- D. Duct Liner: Permacote Linacoustic (rectangular), Permacote Spiracoustic (Round), complying with Thermal Insulation Manufacturer's Association (TIMA) AHC-101; of thickness indicated. 1 inch thick; 2" thick above roofline, unless indicated otherwise. Or approved equal.
- E. Duct Liner Adhesive: Comply with ASTM C 916 "Specifications for Adhesives for Duct Thermal Insulation". Adhesive used on the project shall meet the requirements of CalGreen Section 5.504.4.1.
- F. Duct Liner Fasteners: Comply with SMACNA HVAC Duct Construction Standards, Article S2.11.
- G. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork. Sealant used on the project shall meet the requirements of CalGreen Section 5.504.4.1.
- H. Duct Cement. Non-hardening migrating mastic or liquid neoprene based cement, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork. Cement used on the project shall meet the requirements of CalGreen Section 5.504.4.1.
- I. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
- J. Flexible ducts: Manufacturer based upon Casco Model Silent Flex II. Equal products by Thermaflex or approved equal. Insulated flexible ductwork shall be a factory fabricated assembly composed of a high carbon spring steel wire with a non-corrosive zinc coating spiral helix permanently bound to a spun-bonded nonwoven nylon interior liner, and supporting a fiberglass insulating blanket with a polyethylene jacket vapor barrier. Working pressure: + 1-1/2" W.G. minimum, complying with UL 181; with factory installed metal collar connectors, maximum length 6 feet. Suspend at maximum 3'-0" O.C.
- K. Under slab Ducts: For ductwork placed in concrete slabs, or under slabs on grade, fabricate ductwork of one of the following materials:
  - 1. Galvanized Steel.

**2.03 FABRICATION**

- A. Shop-fabricate ductwork in 4, 8, 10 or 12-ft lengths, unless otherwise indicated or required to complete runs. Preassemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.
- B. Shop-fabricate ductwork of gages and reinforcement complying with SMACNA "HVAC Duct Construction Standards". Ducts shall be fabricated of galvanized sheet metal no less than 24 gauge.

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- C. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.
- D. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division 23 Section "Ductwork Accessories" for accessory requirements.
- E. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners.

**2.04 FACTORY FABRICATED LOW PRESSURE DUCTWORK**

- A. General: At Installer's option, provide factory-fabricated duct and fittings, in lieu of shop-fabricated duct and fittings.
- B. Material: Galvanized sheet steel complying with ASTM A517, lock forming quality, with ASTM A525, G90 zinc coating, mill phosphatized.
- C. Gage: 24-gage minimum for round and oval ducts and fittings, 4" through 24" diameter.
- D. Elbows: One-piece construction for 90 degrees and 45 degree elbows 14" and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint.
- E. Divided Flow Fittings: 90-degree tees, constructed with saddle tap spot welded and bonded to duct fitting body.
- F. Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork of one of the following or equal:
  - 1. Semco Mfg., Inc.
  - 2. United Sheet Metal Div. United McGill Corp.
  - 3. Or approved equal.

**PART 3 - EXECUTION**

**3.01 INSPECTION**

- A. General: Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

**3.02 INSTALLATION OF METAL DUCTWORK**

- A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (5% leakage for systems rated 3" and under; 1% for systems rated over 3") and noiseless (no objectionable noise) systems capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type, which will hold ducts true-to-shape, and to prevent buckling. Support vertical ducts at every floor.
- B. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.
- C. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any.

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Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

- D. Electrical Equipment Spaces: Do not route ductwork through transformer vaults and their electrical equipment spaces and enclosures.
- E. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2". Fasten to duct and substrate.
- F. Where ducts pass through fire-rated floors, walls, or partitions, provide fire stopping between duct and substrate.
- G. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
- H. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards.

**3.03 INSTALLATION OF DUCT LINER**

- A. General: Install duct liner in accordance with SMACNA HVAC Duct Construction Standards.

**3.04 INSTALLATION OF FLEXIBLE DUCT**

- A. Maximum Length: For any duct run using flexible ductwork, do not exceed 5'-0" extended total length.
- B. Installation: Install in accordance with Section III of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".
- C. Bends in flexible ducts shall have a radius of not less 1.5 times the internal diameters.

**3.05 EQUIPMENT CONNECTIONS**

- A. General: Connect metal ductwork to equipment as indicated; provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated.

**3.06 ADJUSTING AND CLEANING**

- A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances, which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.
- B. Temporary closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, or the period of rough installation, or during storage on the construction site and until final startup of the heating and cooling equipment, provide temporary closure of duct openings and protection of mechanical equipment during construction. All duct and other related air distribution component openings shall be covered with polyethylene film, tape, plastic, sheet metal or other methods acceptable to the enforcing agency which will prevent entrance of dust and debris.
- C. Balancing: Refer to Division 23 Section "Testing, Adjusting And Balancing" for air distribution balancing of metal ductwork; not work of this section. Seal any leaks in ductwork that become apparent in balancing process.

**END OF SECTION**

**SECTION 23 33 00**  
**DUCTWORK ACCESSORIES**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Types of ductwork accessories required for project include the following:
  - 1. Dampers
    - a. Low pressure manual dampers
    - b. Control dampers
    - c. Counterbalanced relief dampers
  - 2. Fire and smoke dampers
  - 3. Turning vanes
  - 4. Duct hardware
  - 5. Duct access doors
  - 6. Flexible connections

**1.02 RELATED SECTIONS**

- A. Refer to other Division 23 Sections for testing, adjusting, and balancing of ductwork accessories; not included in work of this section.
- B. Division 23 Section "Metal Ductwork."
- C. Division 23 Section "HVAC Identification."

**1.03 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction; and installation instructions.

**1.04 QUALITY ASSURANCE**

- A. Codes and Standards:
  - 1. SMACNA Compliance: Comply with applicable portions of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".
  - 2. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.
  - 3. UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555 "Fire Dampers and Ceiling Dampers".
  - 4. Fire dampers shall bear California State Fire Marshal Listing Number.
  - 5. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.

**PART 2 - PRODUCTS**

**2.01 DAMPERS**

- A. Low Pressure Manual Dampers: Provide dampers of single blade type or multi-blade type, constructed in accordance with SMACNA "HVAC Duct Construction Standards". "Jiffy" type dampers are not acceptable.

**2.02 BACKDRAFT DAMPERS**

- A. General: Provide back-draft dampers of types and sizes indicated. Construct casings of 0.090-thickness aluminum with mitered corners.
- B. Blades, 0.025" formed aluminum with extruded vinyl edge seals. Bearings, Zytel. Linkage 1/8" x 1/8" aluminum tie bars concealed in frame.
- C. Counterbalance: Zinc plated bar on blades (except top blade). Adjustable for final setting Mill finish.



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- D. Manufacturers: Subject to compliance with requirements, provide dampers of one of the following:
  - 1. Ruskin Manufacturing Co.
  - 2. Air Balance Co.
  - 3. Pottorff Company, Inc.
- E. Control Dampers: Refer to Division 23 section "Sequence of Operation" for control dampers; not work of this section.
- F. Counterbalanced Relief Dampers: Provide dampers with parallel blades, counterbalanced and factory-set to relieve at indicated static pressure. Construct blades of 16-ga aluminum provide 1/2" diameter ball bearings, 1/2" diameter steel axles spaced on 9" centers. Construct frame of 2" x 1/2" x 1/8" steel channel for face areas 25 sq. ft. and under; 4" x 1-1/2" x 16-ga channel for face areas over 25 sq. ft. Provide galvanized steel finish on frame with aluminum touch-up.
- G. Manufacturer: Subject to compliance with requirements, provide dampers of one of the following:
  - 1. Air Balance, Inc.
  - 2. Ruskin Mfg. Co.
  - 3. Pottorff Company, Inc.

**2.03 FIRE AND SMOKE DAMPERS**

- A. California State Fire Marshal approved, designed and constructed in accordance with NFPA 90A and UL Standard 555 and bear stamp showing compliance.
- B. Fire Dampers: Provide fire dampers, of types and sizes indicated. Construct casings of 11-ga galvanized steel. Provide fusible link rated at 160 to 165 degrees F (71 to 74 degrees C) (unless otherwise indicated.) Provide damper with positive lock in closed position, and with the following additional features.
  - 1. Damper Blade Assembly: Curtain type.
- C. Manufacturer: Subject to compliance with requirements, provide fire and smoke dampers of one of the following:
  - 1. Air Balance, Inc.
  - 2. Ruskin Mfg. Co.
  - 3. Pottorff Company, Inc.

**2.04 TURNING VANES**

- A. Manufactured Turning Vanes: Provide turning vanes constructed of 1-1/2" wide curved blades set at 3/4" O.C., supported with bars perpendicular to blades set at 2" O.C., and set into side strips suitable for mounting in ductwork.
- B. Acoustic Turning Vanes: Provide acoustic turning vanes constructed of airfoil shaped aluminum extrusion with perforated faces and fiberglass fill.
- C. Manufacturer: Subject to compliance with requirements, provide turning vanes of one of the following:
  - 1. Aero Dynen Co.
  - 2. Airsan Corp.
  - 3. Anemostat Products Div.; Dynamics Corp. of America
  - 4. Barber-Colman Co.
  - 5. Duro Dyne Corp.
  - 6. Environmental Elements Corp. Subs, Koppers Co., Inc
  - 7. Hart & Cooley Mfg. Co.
  - 8. Register & Grille Mfg. Co., Inc.
  - 9. Souther, Inc.

DUCTWORK ACCESSORIES  
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**2.05 DUCT HARDWARE**

- A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
  - 1. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
  - 2. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.
- B. Manufacturer: Subject to compliance with requirements, provide duct hardware of one of the following:
  - 1. Ventfabrics, Inc.
  - 2. Young Regulator Co.

**2.06 DUCT ACCESS DOORS**

- A. General: Provide duct access doors where required.
- B. Construction: Construct of same or greater gage as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for un-insulated ductwork, extended frames for externally insulated duct. Provide one side hinged and other side with one handle-type latch for doors 12" high and smaller, 2 handle-type latches for larger doors.
- C. Manufacturer: Subject to compliance with requirements, provide duct access doors of one of the following:
  - 1. Air Balance Inc.
  - 2. Duro Dyne Corp.
  - 3. Register & Grille Mfg. Co., Inc.
  - 4. Ruskin Mfg. Co.
  - 5. Ventfabrics, Inc.
  - 6. Zurn Industries, Inc.; Air Systems Div.

**2.07 FLEXIBLE CONNECTORS**

- A. General: Provide flexible duct connections wherever ductwork connects to vibration-isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse and torsional movement, and also capable of absorbing vibration of connected equipment.
- B. Manufacturer: Subject to compliance with requirements, provide flexible connections of one of the following:
  - 1. American/Elgen Co.; Energy Div
  - 2. Duro Dyne Corp.
  - 3. Flexaust (The) Co
  - 4. Ventfabrics, Inc.

**PART 3 - EXECUTION**

**3.01 INSPECTION**

- A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

**3.02 INSTALLATION OF DUCTWORK ACCESSORIES**

- A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Install turning vanes in square or rectangular 90-degree elbows in supply and exhaust air systems, and elsewhere as indicated.

DUCTWORK ACCESSORIES  
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- C. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.
- D. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

**3.03 FIELD QUALITY CONTROL**

- A. Operate install ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leak proof performance.

**3.04 ADJUSTING AND CLEANING**

- A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.
  - 1. Label access doors in accordance with Division 23 Section "HVAC Identification."
  - 2. Final positioning of manual dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."
- B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

**3.05 EXTRA STOCK**

- A. Furnish extra fusible links to Owner, one link for every 10 installed of each temperature range; obtain receipt.

**END OF SECTION**

**SECTION 23 34 23**  
**POWER AND GRAVITY VENTILATORS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Types of power and gravity ventilators specified in this section include the following:
  - 1. Power ventilators.
    - a. Centrifugal roof ventilators.
    - b. In-Line roof ventilators.
  - 2. Gravity ventilators.
    - a. Hooded gravity ventilators.
  - 3. Prefabricated roof curbs.

**1.02 RELATED SECTIONS**

- A. Refer to Division 23 Section "Testing, Adjusting, And Balancing" for balancing of power and gravity ventilators; not work of this section.
- B. Refer to Division 23 Section "Common Motor Requirements for Mechanical Equipment."
- C. Refer to Division 26 Sections for the following work; not included in work of this section:
  - 1. Power supply wiring from power source to power connection on ventilators. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.
- D. Refer to Division 23, Section "Vibration Control for HVAC."

**1.03 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical data for power and gravity ventilators, including specifications, capacity ratings, dimensions, weights, materials, accessories furnished, and installation instructions.
- B. Fan curve: Submit manufacturer's fan curve data for power ventilators.
  - 1. For belt driven equipment, submit graph of fan curve with system curve that indicates intended-point of operation. The graph shall also indicate manufacturer's recommended operating range of fan curve.
  - 2. For direct driven equipment with speed controller, submit graph of fan curve with system curve that indicates intended point of operation. The graph shall also indicate manufacturer's recommended operating range of fan curve. On the same graph, also provide fan curves representing maximum operating RPM and minimum operating RPM utilizing manufacturer's speed controller.
  - 3. For direct driven equipment, submit graph of fan curve with system curve that indicates intended point of operation. The graph shall also indicate manufacturer's recommended operating range of fan curve.
- C. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, methods of assembly of components, and field connection details.
- D. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to power ventilators. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field installed.
- E. Maintenance Data: Submit maintenance data and parts list for each type of power and gravity ventilator, accessory, and control. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual; in accordance with requirements of Division 01.
- F. Exhaust fan unit equipment manufacturer shall furnish calculations showing the estimated sound power levels for each supply air, return air and unit casing radiation for each exhaust fan unit.

POWER AND GRAVITY VENTILATORS  
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- G. The results of the tests shall be certified by the testing agency and submitted to the Architect for approval. The report shall include the manufacturer's designation of the tested unit, a complete description of the testing conditions, the measurement procedure, and the calculated PWL values (dB re. 10-12 watts), and calculations showing how the sound power levels were obtained from test data.

**1.04 QUALITY ASSURANCE**

- A. Codes and Standards:
1. AMCA Compliance: Provide power ventilators, which have been tested and rated in accordance with AMCA standards, and bear AMCA Certified Rating Seal.
  2. UL Compliance: Provide power ventilators, which are designed, manufactured, and tested in accordance with UL 705 "Power Ventilators".
  3. NEMA Compliance: Provide motors and electrical accessories complying with NEMA Standards.

**PART 2 - PRODUCTS**

**2.01 POWER VENTILATORS**

- A. General: Except as otherwise indicated, provide standard prefabricated power ventilator units of type and size indicated, modified as necessary to comply with requirements and as required for complete installation.

**2.02 CENTRIFUGAL ROOF VENTILATORS (EXHAUST AND SUPPLY)**

- A. Centrifugal Roof Ventilators: Provide centrifugal roof type, curb mounted, power ventilators of type, size, and capacity as scheduled, and as specified herein.
- B. Type: Centrifugal fan, direct or belt driven as scheduled. Provide aluminum, or fiberglass weatherproof housings as scheduled. Provide square base to suit roof curb.
- C. Motors: Provide permanent split-capacitor type motor for direct driven fans; capacitor-start, induction-run type motor for belt driven fans.
- D. Electrical: Provide factory-wired non-fusible type disconnect switch at motor in fan housing. Provide thermal overload protection in fan motor. Provide conduit chase within unit for electrical connection.
- E. Bird Screens: Provide removable bird screen, 1/2" mesh 16-Ga. aluminum or brass wire.
- F. Dampers: Provide gravity-actuated louvered dampers in curb bases unless noted to provide motorized louvered dampers with linkage in curb base.
- G. Manufacturer: Subject to compliance with requirements, provide centrifugal roof ventilators of one of the following:
1. Cook Co., Loren.
  2. Greenheck Fan Corp.
  3. Or approved equal.

**2.03 GRAVITY VENTILATORS**

- A. General: Except as otherwise indicated, provide standard prefabricated gravity ventilator units of type and size indicated, modified as necessary to comply with requirements, and as required for complete installation.
- B. Hooded Gravity Ventilators: Provide gravity ventilators, hooded type, curb mounted, of size, type and capacity as scheduled, and as specified herein.
1. Type: Stationary, natural draft type. Provide weatherproof housings to match power ventilators in materials and finish. Provide square or rectangular base to suit roof curb.
  2. Bird Screens: Provide removable bird screens, 1/2" mesh, 16-Ga. aluminum or brass wire.
  3. Dampers: Provide gravity-actuated louvered dampers in curb bases.

POWER AND GRAVITY VENTILATORS  
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4. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
  - a. Cook Co., Loren.
  - b. Greenheck Fan Corp.
  - c. Or approved equal.

**2.04 PREFABRICATED ROOF CURBS**

- A. General: Provide manufacturer's standard shop-fabricated units, modified if necessary to comply with requirements.
- B. Fabricate structural framing for units of structural quality, aluminum formed to profiles indicated or, if not indicated, to manufacturer's standard profiles for coordination with roofing, insulation and deck construction. Include 45-degree cant strips and deck flanges with offsets to accommodate roof insulation. Weld corners and seams to form watertight units.
- C. Reinforce continuous runs of over 3'-0" length by inserting welded stiffeners of heavy gage with flanges as required to provide sufficient rigidity and strength to withstand maximum lateral forces in addition to superimposed vertical loads.
- D. Sloping Roof Decks: For deck slopes of 1/4" per foot and more, fabricate support units to form level top edge.
- E. Gage and Height: Fabricate units of metal gage and to height above roof surface as indicated.
- F. Where gage or height is not indicated, fabricate units of 14-Ga. metal, and nominal height of 14".
- G. Insulate units inside structural support wall with rigid glass fiber insulation board of approximately 3-Lb. density and 1-1/2" minimum thickness, except as otherwise indicated.
- H. Provide support liners where shown.
  1. Use perforated metal for support liners, with approximately 1000, 3/32" diameter holes per Sq. Ft., to provide sound absorbing surfaces.
  2. Provide sound insulation insert for curbs so indicated. Construct of 1" thick rigid fiberglass panels secured in galvanized steel framework, with rounded edges to minimize airflow resistance.
- I. Manufacturer: Subject to compliance with requirements, provide prefabricated roof curbs of the same manufacturer as ventilator.

**PART 3 - EXECUTION**

**3.01 INSPECTION**

- A. General: Examine areas and conditions under which power and gravity ventilators are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

**3.02 INSTALLATION OF POWER AND GRAVITY VENTILATORS**

- A. General: Except as otherwise indicated or specified, install power ventilators in accordance with manufacturer's installation instructions and recognized industry practices to insure that products serve the intended function.
- B. Coordinate ventilator work with work of roofing, walls and ceilings, as necessary for proper interfacing.
- C. Ductwork: Refer to Division 23 Section "Metal Ductwork." Connect ducts to ventilators in accordance with manufacturer's installation instructions.
- D. Roof Curbs: Furnish roof curbs to roofing Installer for installation.

POWER AND GRAVITY VENTILATORS  
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- E. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
  - 1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 Sections.
  - 2. Verify proper rotation direction of fan wheels. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
- F. Remove shipping bolts and temporary supports within ventilators. Adjust dampers for free operation.

**3.03 FIELD QUALITY CONTROL**

- A. Testing: After installation of ventilators has been completed, test each ventilator to demonstrate proper operation of unit at performance requirements specified. When possible, field correct malfunctioning units, and then retest to demonstrate compliance. Replace units, which cannot be satisfactorily corrected.

**3.04 ADJUSTING AND CLEANING**

- A. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

**3.05 SPARE PARTS**

- A. General: Furnish to Owner, with receipt, one spare set of belts for each belt driven power ventilator.

**END OF SECTION**

**SECTION 23 37 13**  
**AIR OUTLETS AND INLETS**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Types of outlets and inlets required for project include the following:
  - 1. Linear slot diffusers and returns.
  - 2. Ceiling air diffusers, rectangular, square, round.
  - 3. Wall registers and grilles.

**1.02 RELATED SECTIONS**

- A. Refer to other Division 23 Sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.
- B. Refer to other Division 23 Sections for balancing of air outlets and inlets; not work of this section.

**1.03 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
  - 1. Schedule of air outlets and inlets indicating drawing designation, room location, quantity furnished, model number, size, and accessories furnished.
  - 2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.
  - 3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.
  - 4. ANSI/ASHRAE Standard 70-1991.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.
- C. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 01.

**1.04 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver air outlets and inlets wrapped in factory-fabricated fiberboard type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.
- B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors, when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

**1.05 QUALITY ASSURANCE**

- A. Codes and Standards:
  - 1. ANSI/ASHRAE Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ANSI/ASHRAE Standard 70-1991.
  - 2. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems."

**PART 2 - PRODUCTS**

WD 20624

FILLMORE HIGH SCHOOL  
MODERNIZATION

01/26/2021



## AIR OUTLETS AND INLETS

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### 2.01 CEILING AIR DIFFUSERS

- A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems, which will contain each type of ceiling air diffuser.

### 2.02 MANUFACTURER

- A. Subject to compliance with requirement diffusers of one of the following:
  - 1. Krueger Mfg. Co.
  - 2. Titus Air Distribution Products
  - 3. Anemostat Air Distribution Products
- B. Manufacturers and model numbers are listed and/or scheduled to set a standard of quality. Equivalent manufacturers and models accepted by Architect/Engineer may be used. Equivalents must be submitted for review.
  - 1. Equivalents: Other manufacturers offering a similar product which is in accordance with the design criteria indicated may be submitted upon architect's written acceptance prior to bidding. The cost to conduct all tests as may be directed by the architect to demonstrate that the equivalent product can achieve the criteria indicated, including all travel costs, shall be borne by the submitting contractor.

### 2.03 LINEAR SLOT DIFFUSER AND RETURN

- A. General: Provide acoustical ceiling air distribution system. Consisting of ceiling slot air diffusers, base-frames, air chambers and entry collars.
- B. Air Distribution Base Frames:
  - 1. Linear air diffusers base frames shall mechanically lock into the grid system. The base frames shall be extruded aluminum sections. Length shall be 48" unless otherwise noted or required.
  - 2. Provide air distribution base frame with full supply air pattern control air weir gates. When used for return air, these air weir gates act as a return airflow control damper. Close air weir gates where return is not necessary.
  - 3. Base frame shall present a substantially uniform appearance through the air slot when used as supply, returns or fully closed. All interior portions of the throat, including the vertical stems of the extrusions, shall be painted flat black to prevent unsightly visual deviations. Paint all exposed surfaces baked white enamel. Base frame shall be compatible with type of ceiling where linear slot diffuser is installed.
  - 4. Base frame shall be provided with spacer channels located on the ceiling module. The spacer channel shall act as the support means for the adjustable full pattern control air weir gates, which are provided throughout the entire length of the base frame.
  - 5. The noise criteria of the air distribution base frame shall be expressed in sound power levels (decibels 10-12 Watts) in octave bands 2 through 7 with a room attenuation of 10 decibels and shall not exceed noise-criteria of 30. All data shall be based on tests performed in a certified laboratory.
  - 6. Where noted on drawings or as required, blank-off airtight backside of supply air linear slot where duct connection is not made.
- C. Supply or Return Air Chambers:
  - 1. Supply or Return air plenum chambers shall be designed, tested, and fabricated by the same manufacturer that furnishes the base frames. Shop fabricated air chambers not

## AIR OUTLETS AND INLETS

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- acceptable. Provide with damper at inlet to plenum, which is accessible through face of linear diffuser for adjustment.
2. Provide adjustable air pattern controllers that are accessible through the base frame slot for field adjustment of the spread of the air stream. This will be accomplished without the removal of acoustical tile.
  3. Provide a round neck air entry collar sized for maximum average air entry velocity of 750 FPM. A volume damper shall be installed at connection to plenum, which is accessible through face of diffuser for adjustment.
  4. Construct supply air chamber from not less than 26 gauge galvanized steel and will be lined with one- quarter inch 2 Lbs./Cu. Ft. density thermal acoustical insulating. All surfaces visible through the slot will be painted flat black.
  5. Provide spring clip keepers to securely attach the chamber to the base frame when in operation. These spring clips permit releasing of the air chamber for easy relocation.
  6. The supply air chamber shall have been tested as composite assembly with the linear base frame for air distribution and noise level performance. The tests shall be conducted in accordance with ANSI/ASHRAE Standard 70-1991.
  7. For return air plenums above the ceiling, install Krueger Model DFRH plenum hood on all linear return air bars.

D. Manufacturer: Krueger Model DFL linear slot diffuser.

### **2.04 SIDEWALL SUPPLY AND RETURN REGISTERS AND GRILLES**

- A. Supply register - Krueger 1600 or as indicated elsewhere on contract documents.
- B. Return register - Krueger S-5480 or as indicated elsewhere on contract documents.
- C. Return grille - Krueger S-5480 or as indicated elsewhere on contract documents.

### **2.05 CONSTANT AIR VOLUME SYSTEM - CEILING DIFFUSERS (SUPPLY)**

- A. Concealed Spline - Krueger 5PLQ or as indicated elsewhere on contract documents.
- B. Glued on Acoustile - Krueger 5PLQ or as indicated elsewhere on contract documents.
- C. Plaster or Drywall - Krueger 5PLQ or as indicated elsewhere on contract documents.
- D. 24" x 24" T-Bar - Krueger 5PLQ or as indicated elsewhere on contract documents.

Note: For 24" x 48" T-bar ceilings, coordinate with ceiling installer for auxiliary tees as required to create 24" x 24" space.

### **2.06 CONSTANT AIR VOLUME SYSTEM - CEILING RETURN, EXHAUST AND TRANSFER GRILLES AND REGISTERS**

- A. Registers shall be provided with opposed blade dampers.
- B. Concealed Spline - Krueger EGC5 or EGC5-01 or as indicated elsewhere on contract documents.
- C. Glued on Acoustile - Krueger EGC5 or EGC5-01 or as indicated elsewhere on contract documents.
- D. Plaster or drywall - Krueger EGC5 or EGC5-01 or as indicated elsewhere on contract documents.
- E. 24" x 24" T-bar - Krueger EGC5-F23 or EGC5-01-F23 or as indicated elsewhere on contract documents.

Note: For 24" x 48" T-bar ceilings, coordinate with ceiling installer for auxiliary tees as required to provide 24" x 24" space.

F. Transfer Grille - Ceiling - Same as return grilles.

### **2.07 VARIABLE AIR VOLUME SYSTEM - MODULAR CEILING DIFFUSERS (SUPPLY)**

- A. Krueger Model 1900SQ and shall have a frame style to interface with the ceiling grid system being used.

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- B. Manufactured from extruded aluminum. Provided with air pattern control weirs, and an integral deflection rail allowing for one- to four-way direction air flow producing uniform ceiling effect.
- C. The air motion in the occupancy zone at maximum cubic feet per minute shall not exceed 50 feet per minute. Inner panel of matching acoustical tile shall provide an airtight joint.
- D. Supply, Return and Exhaust Chambers:
  - 1. Designed and fabricated by the manufacturer of the base frames. Field fabricated chambers will not be accepted. Chamber to be supplied with spring clips to attach to the base frame. Constructed from not less than 26 gauge galvanized steel and lined with 1/4" 2 LBS/CU. FT. density thermal insulation. All surfaces visible through the air slot painted flat black.
  - 2. Chamber shall be supplied with a factory installed round entry collar for flex duct connection. Collar shall be sized for maximum average air entry velocity of 750 fpm. Chamber must be tested as a composite assembly with the base frame for air distribution and noise level performance by a certified testing laboratory. If used with side inlet, furnish and install vertical pressure equalizing baffle.

### **2.08 VARIABLE AIR VOLUME SYSTEM - MODULAR CEILING RETURN**

- A. Krueger Model 1900SQ Return diffuser.
- B. Base frame from extruded aluminum. Frame shall have fixed weirs creating a continuous one-inch closed slot. Provide opposite blade volume damper.

### **2.09 VARIABLE AIR VOLUME SYSTEM - TRANSFER GRILLES**

- A. Krueger Model 1900SQ Return diffuser.
- B. Base frame from extruded aluminum. Frame shall have fixed weirs creating a continuous one-inch closed slot. Provide opposite blade volume damper.

### **2.10 SUPPLY, RETURN AND EXHAUST CONNECTIONS TO METAL LINEAR CEILING**

- A. Air Factors sheet metal air boot (eight-slot for connecting to back of metal linear ceiling with slot openings with labyrinths, as applicable) for supply, return, and exhaust. Air boot shall lock onto back of ceiling system.

### **2.11 CIRCULAR CEILING DIFFUSERS**

- A. Krueger Model RA2 circular diffuser with adjustable inner cone.

## AIR OUTLETS AND INLETS

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### **PART 3 - EXECUTION**

#### **3.01 INSPECTION**

- A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

#### **3.02 INSTALLATION**

- A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.
- B. Provide 12" high plenum box with 1" acoustical insulation. Refer to installation detail on plans for additional requirements.
- C. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.
- D. Coordinate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling module.
- E. Supply outlets to provide the required air throw and spread with no apparent drafts or excessive air movement within space being supplied. Contractor to provide necessary accessories to accomplish satisfactory air distribution.
- F. Provide felt, cork or rubber gasket between finish-surface and frame to prevent vibration and assure tight fit. Contractor shall be responsible for the correct location of ductwork and outlets.
- G. For filler panel type outlets the manufacturer shall coordinate his design with the ceiling suspension system being used. The Contractor and manufacturer shall match up sizes of outlets to properly fit in ceiling systems, between concrete or masonry components, between architectural items before fabrication.
- H. When installing removable core type outlets, secure to frame with screws.
- I. Secure outlets to ceiling suspension systems as required by Division of the State Architect.

**END OF SECTION**

**SECTION 23 74 13  
PACKAGED ROOFTOP HEAT PUMPS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Package roof top unit.
- B. Heat exchanger.
- C. Refrigeration components.
- D. Unit operating controls.
- E. Roof curb.
- F. Electrical power connections.
- G. Operation and maintenance service.

**1.02 RELATED SECTIONS**

- A. Section 23 0513 "Common Motor Requirements for HVAC Equipment."
- B. Section 23 0548 "Vibration Control for HVAC."
- C. Section 23 0700 "HVAC Insulation."
- D. Section 23 0900 "Instrumentation and Controls for HVAC."
- E. Section 26 0000 "Equipment Wiring Systems."

**1.03 REFERENCES**

- A. NFPA 90 A & B - Installation of Air Conditioning and Ventilation Systems and Installation of Warm Air Heating and Air Conditioning Systems.
- B. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.
- C. ANSI/ASHRAE 37 - Testing Unitary Air Conditioning and Heat Pump Equipment.
- D. ANSI/ASHRAE/IESNA 90.1-1999 - Energy Standard for New Buildings Except Low-Rise Residential Buildings.
- E. ANSI Z21.47/UL1995 - Unitary Air Conditioning Standard for safety requirements.
- F. California Energy Commission Administrative Code - Title 20/24 - Establishes the minimum efficiency requirements for HVAC equipment installed in new buildings in the State of California.
- G. ANSI/NFPA 70-1995 - National Electric Code.

**1.04 SUBMITTALS**

- A. Submit unit performance data including: capacity, nominal and operating performance.
- B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.
- C. Submit shop drawings indicating overall dimensions as well as installation, operation and services clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.
- D. Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.
- E. Shop drawings submitted for approval shall be accompanied by a copy of the purchase agreement between the Contractor and an authorized service representative of the manufacturer for check, test and start up and first year service.

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**1.05 DELIVERY, STORAGE and HANDLING**

- A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
- B. Protect units from physical damage. Leave factory-shipping covers in place until installation.

**1.06 WARRANTY**

- A. The entire unit shall be covered by manufacturer's written parts warranty by manufacturer for one year AFTER project completion and owner acceptance
- B. The entire unit installation, material and workmanship shall be covered by Contractor's written labor and parts warranty by Contractor for one year AFTER project completion and owner acceptance

**1.07 SPECIAL WARRANTY**

- A. Warranty on Compressor: Provide written warranty, agreeing to replace/repair, including all parts and labor within warranty period, compressors with inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period set in section 1.06.
- B. Extended warranty period. Provide written warranty signed by manufacturer, agreeing to replace components parts only, for an additional four (4) years for all hermetically sealed compressors.

**1.08 REGULATORY REQUIREMENTS**

- A. Unit shall conform to ANSI Z21.47/UL1995 for construction of packaged air conditioner.
  - 1. In the event the unit is not UL approved, the manufacturer must, at his expense, provide for a field inspection by a UL representative to verify conformance to UL standards. If necessary, contractor shall perform modifications to the unit to comply with UL, as directed by the UL representative, at no additional expense to the Owner.

**PART 2 PRODUCTS**

**2.01 SUMMARY**

- A. The contractor shall furnish and install high efficiency package rooftop heat pump unit(s) as shown and scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.
- B. APPROVED MANUFACTURERS:
  - 1. Rheem: Basis of Design
  - 2. Carrier: Alternate
  - 3. Trane: Alternate
- C. Units as manufactured by Rheem are used as the basis of design and are the college district standard. Their capacities, weights dimensions, and, mechanical, structural and electrical characteristics are scheduled on the drawings and contract documents. Use of alternate units requires college districts preapproval 10 working days prior to bid. Contractor shall include such approval in their bid documents. By submitting Alternate equipment, contractor shall bear all additional cost and responsibility associated with all additional electrical, mechanical, structural, Title-24 energy calculations. Contractor shall be responsible for resubmitting and obtaining DSA approval for all such changes. Contractor shall provide As-built drawing based on the Alternate equipment information at the project closeout.
- D. Rheem units are used as the basis of design and their efficiencies are the bases of energy calculations for Title-24 compliance. Contractor submitting units by other manufacturers named in this specification as alternate shall provide the required Title-24 calculations demonstrating compliance. This effort shall be at no cost to the owner, and all required calculations shall be submitted within 14 calendar days after the award of contract. Job will be awarded on basis of specified product. Alternates must comply with the performance and features as specified within these specifications and indicated on the design documents. Any and all additional cost

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due to submission of alternate units for redesign and/or increase in construction cost of other trades and/or re-submittal fee to DSA and authorities having jurisdiction shall be borne by the contractor.

**2.02 GENERAL UNIT DESCRIPTION**

- A. Unit(s) furnished and installed shall be Rheem RJPL-A High Efficiency Heat Pump packaged rooftop (s) as scheduled on contract documents and these specifications. Cooling capacity ratings shall be based on AHRI Standards. Unit(s) shall consist of insulated weather-tight casing with compressor(s), air-cooled condenser coil, condenser fans, evaporator coil, return-air filters, supply motors and unit controls.
- B. Unit(s) shall be 100% factory run tested and fully charged with R-410A.
- C. Unit(s) shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.
- D. Units shall be convertible airflow design as manufactured.
- E. Wiring internal to the unit shall be colored and numbered for identification.

**2.03 UNIT CABINET**

- A. Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with pre-painted baked enamel finish on all externally exposed surfaces.
  - 1. Unit cabinet exterior paint shall be: film thickness, (dry) 0.003 inches minimum, gloss (per ASTM D523, 60°F): 60, Hardness: H-2H Pencil hardness.
  - 2. Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 210/240 or 340/360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum 3/4-in. thick, 1 lb density, flexible fiberglass insulation, aluminum foil-faced on the air side.
- B. Base of unit shall have locations for thru-the-base electrical connections (factory installed or field installed), standard.
- C. Base Rail
  - 1. Unit shall have base rails on all sides.
  - 2. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging.
  - 3. Holes shall be provided in the base rail for moving the rooftop by fork truck.
  - 4. Base rail shall be a minimum of 14 gauge thickness.
- D. Condensate pan and connections:
  - 1. Shall be a sloped condensate drain pan made of a non-corrosive material.
  - 2. Shall comply with ASHRAE Standard 62.
  - 3. Shall use a 1" -11 1/2 NPT drain connection, through the side of the drain pan. Connection shall be made per manufacturer's recommendations.
- E. Top panel:
  - 1. Indoor section shall be a single piece top panel.
- F. Electrical Connections
  - 1. All unit power wiring shall enter unit cabinet at a single, factory-prepared, knockout location.
  - 2. Thru-the-base capability
    - a. Standard unit shall have a thru-the-base electrical location(s) using a raised, embossed portion of the unit base pan.
    - b. No base pan penetration, other than those authorized by the manufacturer, is permitted.
- G. Component access panels shall be easily removable for servicing.

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**2.04 AIR FILTERS**

- A. Air Filters: Factory installed filters shall mount integral within the unit and shall be accessible through hinged access panels. Units shall be provided with a 2" MERV 13 filter.

**2.05 FANS AND MOTORS**

- A. Provide evaporator fan section with forward curved, double width, double inlet, centrifugal type fan.
- B. Provide self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings.
- C. Provide units 5 tons and below with direct drive, multiple speed, dynamically balanced supply fans.
- D. Provide units 6 tons and above with belt driven, supply fans with adjustable motor sheaves.
- E. Outdoor and Indoor Fan shall be permanently lubricated and have internal thermal overload protection.
- F. Outdoor fans shall be direct drive, statically and dynamically balanced, draw through in the vertical discharge position.
- G. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

**2.06 EVAPORATOR COIL**

- A. Provide configured aluminum fin surface mechanically bonded to copper tubing coil.
- B. Provide an independent expansion device for each refrigeration circuit. Factory pressure tested at 450 psig and leak tested at 200 psig.
- C. Provide a removable, reversible, cleanable double sloped drain pan for base of evaporator coil constructed of PVC.

**2.07 CONDENSER SECTION**

- A. Provide vertical discharge, direct drive fans with aluminum blades. Fans shall be statically balanced. Motors shall be permanently lubricated, with integral thermal overload protection in a weather tight casing.

**2.08 REFRIGERATION SYSTEM**

- A. Compressor(s): Provide scroll compressor with direct drive operating at 3600 rpm. Integral centrifugal oil pump. Provide suction gas cooled motor with winding temperature limits and compressor overloads.
- B. Units shall have cooling capabilities down to 0 degree F as standard. For field-installed low ambient accessory, the manufacturer shall provide a factory-authorized service technician that will assure proper installation and operation.
- C. For heat pump units, provide reversing valve, discharge muffler, flow control check valve, and electronic adaptive demand defrost control on all units.

**2.09 ULTRAVIOLET EMITTERS**

- A. Manufacturer: Steril-Aire (Ultra Violet Emitters)
- B. Emitter and fixture shall be factory assembled and tested. They shall consist of a fixture, power supply, support bracket/reflector, Emitter socket and Emitter.
- C. Fixture shall be constructed to NEMA 4x standards to withstand outdoor environments and shall be equipped with a ½" electrical conduit openings to facilitate wiring. All components shall be incorporated into one integral assembly that maximizes serviceability.
- D. Power supply shall be a Class P2, electronic rapid start type with a power factor of >0.98 and a power conversion of >90%. It shall be available in 120-277 V, 50/60 Hz, single phase (will



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perform satisfactorily @ 100 V - 277 V). It shall be designed to maximize photon production, irradiance and reliability in cold airstreams of 0-140°F, 100% RH.

- E. Emitter shall be a very high output, hot cathode, T5 diameter, Steril-Aire Enhanced® type that produces a germicidal UVC band of 253.7 nm. The EGTS Emitter shall operate in air velocities of up to 2000 fpm and air temperatures of 35-140°F. It shall produce no ozone or other secondary contaminants.
- F. Unit shall comply with UL Standards 153, 1598, 1995 and CSA and CE Standards. The manufacturer shall be an ISO 9001:2015 and ISO 14001:2015 certified facility.

**2.10 BI-POLAR IONIZATION:**

- A. Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a plasma ion generator with bipolar ionization output as noted below.
- B. Effectively killing microorganisms downstream of the bipolar ionization equipment (mold, bacteria, virus, etc.).
- C. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.
- D. Reducing space static charges and space particle counts
- E. All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition as noted below. Manufacturers not provided the equivalent space kill rates shall not be acceptable.
  - 1. MS2 Bacteriophage (COVID): 99.0% in 10 minutes or less
  - 2. MRSA: 99.5% in 60 minutes or less
  - 3. E. Coli: 99.4% in 30 minutes or less
  - 4. H1N1: 86.6% in 60 minutes or less
  - 5. H1N5: 99.0% in 60 minutes or less
  - 6. Staphylococcus Aureus 91.5% in 60 minutes or less
  - 7. Aspergillus Niger: 97.1% in 60 minutes or less
  - 8. Candida Albicans: 36.0% in 30 minutes or less
  - 9. Pseudomonas Aeruginosa 99.9% in 60 minutes or less
  - 10. Cladosporium 97.7% in 60 minutes or less
  - 11. Dichobotrys Abundans 90.0% in 60 minutes or less
  - 12. Penicillium 95.0% in 60 minutes or less
  - 13. Bacillus Subtilis var Niger 89.3% in 60 minutes or less
- F. The bipolar ionization system shall operate in such a manner that equal amounts of positive and negative ions are produced. Single pole ion devices shall not be acceptable.
- G. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration or dangerous conditions to the air purification system.
- H. Ionization Equipment Requirements:
  - 1. Each plasma generator with bipolar ionization output shall include the required number of electrodes and power generators sized to the air handling equipment capacity.
  - 2. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating.
  - 3. Ionization output when tested in the occupied space shall be between 800 to 1200 ions/cm<sup>3</sup>.
  - 4. Manufacturer shall demonstrate that no voltage potential exists due to exposed electrical components in the duct system or plenum. Exposed needles protruding into the air stream

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will not be accepted.

- I. RTU Installation:
  - 1. Ion generators for DX Packaged Rooftop Units shall be brush type needlepoint units similar to Plasma Air PA600/660 series is designed to be mounted at the fan inlet.
  - 2. The unit shall be rated to treat up to 2,400 CFM or 6 tons nominal capacity. For airflows greater than 2,400 CFM, multiple units shall be utilized.
  - 3. The PA600/660 housing is made from ABS plastic, contains an LED ionization output indicating LED, and an in-line 1 Amp fuse.
  - 4. The unit shall contain two (2) mounting feet and shall be configured so the needles are oriented perpendicular to the flow of air entering the fan wheel.
  - 5. Plasma Air 660 series include integral dry contacts which indicate ionizer functionality to a Building Automation System (BAS).
- J. Certifications:
  - 1. Bipolar ionization units shall be tested and listed by either UL or ETL according to UL Standard 867 – Electrostatic Air Cleaners and/or UL 2998 - Environmental Claim Validation Procedure (ECVP) for Zero Ozone Emissions from Air Cleaners.
- K. Electrical Requirements:
  - 1. Ion generators shall contain a built-in power supply and operate on 24V AC and shall connect to the fan and common terminals of the air handling unit served. Ion generators requiring a loose 24V, 120V or 230V transformer or power supply shall not be accepted.
  - 2. Wiring, conduit and junction boxes shall be furnished and installed by the electrical contractor within housing plenums and shall be UL and NEC NFPA 70 approved.
- L. Bipolar Ionization Control Requirements:
  - 1. All plasma ion generators shall include internal short circuit protection, overload protection, and automatic fault reset. Manual fuse replacement shall not be accepted.
  - 2. Plasma ion generator shall include an external BMS interface to indicate ion generator status and alarm.

## **2.11 OUTDOOR AIR SECTION**

- A. Provide modulating economizer with 100% outside air capability. Use economizer as the first stage of cooling when outside air temperature is below 63 degree F.
- B. Provide economizer with Title 24 compliant Dry-bulb controls on all units.
- C. Provide adjustable minimum position control located in the economizer section of the unit.
- D. Provide spring return motor for outside air damper closure during unit shutdown or power interruption.

## **2.12 OPERATING CONTROLS**

- A. Provide microprocessor unit-mounted DDC control which when used with an electronic zone sensor provides proportional integral room control. This UCM shall perform all unit functions by making all heating, cooling, and ventilating decisions through resident software logic.
- B. Provide factory-installed indoor evaporator defrost control to prevent compressor slugging by interrupting compressor operation.
- C. Provide an anti-cycle timing and minimum on/off between stages timing in the microprocessor.
- D. Economizer Preferred Cooling - Compressor operation is integrated with economizer cycle to allow mechanical cooling when economizer is not adequate to satisfy zone requirements. Compressors are enabled if space temperature is recovering to cooling set-point at a rate of less than 0.2 degrees per minute. Compressor low ambient lockout overrides this function.

## **2.13 ROOF CURB**

- A. General: Roof Curb shall be of down-shot arrangement and shall be of an approved

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manufacturer as indicated on the drawings and specification Section 23 0548 and shall include an insulated panel under compressor section to prevent condensation forming on the bottom. Dimensions shall be provided to allow for each duct location and connection to roof curb prior to unit placement. Roof curb shall be pitched roof curb with level top surface based on the slope of the roof and shall be a minimum of 14 in. high, except otherwise noted on drawings. Curb design shall comply with National Roofing Contractors Association requirements and shall meet all local and seismic requirements.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine areas and conditions under which rooftop units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

#### **3.02 INSTALLATION**

- A. General: Install rooftop units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Support: Install and secure roof curb to roof structure, in accordance with National Roofing Contractors Association (NRCA) installation recommendations and shop drawings. Install and secure rooftop units on curbs and coordinate roof penetrations and flashing.
- C. Provide substructure as required to set curbs plumb and level.
- D. Electrical Connections: Refer to Section "Electrical Connections for Equipment" for final connections to equipment and installation of loose shipped electrical components.
- E. Unit protection: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, or the period of rough installation, or during storage on the construction site and until final startup of the heating and cooling equipment, provide temporary closure of duct openings and protection of mechanical equipment during construction. All duct and other related air distribution component openings shall be covered with polyethylene film, tape, plastic, sheet metal or other methods acceptable to the enforcing agency which will prevent entrance of dust and debris.

#### **3.03 DEMONSTRATION**

- A. Start-Up Services:
  - 1. Provide the services of a factory-authorized service representative to start-up units, in accordance with manufacturer's written start-up instructions. Test controls and demonstrate compliance with requirements.
  - 2. Replace damaged or malfunctioning controls and equipment. Provide written start-up report for each unit.
- B. Operating and Maintenance Training:
  - 1. Provide two (2), four hour training classes by manufacturer's service representative to instruct Owner's personnel on how to operate and maintain the unit.
  - 2. Video Tape each class and provide three (3) digital copy of each class to the Owner at the end of each class.
  - 3. Training provided by manufacturer's service representative to instruct Owner's personnel in operation and maintenance of units shall include start-up and shutdown, servicing and preventative maintenance schedule and procedures, and trouble-shooting procedures plus procedures for obtaining repair parts and technical assistance. Review operating and maintenance data contained in the Operating and Maintenance Manuals specified in Division 01.

**END OF SECTION 23 74 13**

**SECTION 26 01 00**

**GENERAL ELECTRICAL SPECIFICATIONS**

**1.1 WORK INCLUDED:**

- A. This specification shall apply to all phases of Work hereinafter specified, shown on Drawings, or as required to provide a complete installation of electrical systems for this Project. Work required under this specification, is not limited to just the Electrical Drawings - refer to Architectural, Structural, Landscape, and Mechanical / Plumbing Drawings, as well as all other drawings applicable to this project, which designate the scope of work to be accomplished. The intent of the Drawings and Specifications is to provide a complete and operable electrical system that includes all documents that are a part of the Contract.
1. Work Included. Furnish labor, material, services and skilled supervision necessary for the construction, erection, installation, connections, testing, and adjustment of all circuits and electrical equipment specified herein, or shown or noted on Drawings, and its delivery to the Owner complete in all respects ready for use.
  2. The electrical Work includes installation or connection of certain materials and equipment furnished by others. Verify installation details, installation and rough-in locations from the actual equipment or from the equipment shop drawings.
- B. Electrical Drawings. Electrical Drawings are diagrammatic, and are intended to convey the scope of work, indicating intended general arrangement of equipment, conduit and outlets. Follow Drawings in laying out Work and verify spaces for installation of materials and equipment based on actual dimensions of equipment furnished.

**1.2 QUALITY ASSURANCE**

- A. Design, manufacture, testing and method of installation of all apparatus and materials furnished under requirements of these specifications shall conform to latest publications or standard rules of the following:
- Institute of Electrical and Electronic Engineers - IEEE
  - National Electrical Manufacturers' Association - NEMA
  - Underwriters' Laboratories, Inc. - UL
  - National Fire Protection Association - NFPA
  - Federal Specifications - Fed. Spec.
  - American Society for Testing and Materials - ASTM
  - American National Standards Institute - ANSI
  - National Electrical Code - NEC
  - National Electrical Safety Code - NESC
  - Insulated Cable Engineers Association - ICEA
  - American Institute of Steel Construction - AISC
  - State and Municipal Codes In Force In The Specific Project Area
  - Occupational Safety and Health Administration (OSHA)
  - Electronics Industries Association/ Telecommunications Industry Association (EIA/TIA)
  - California Electrical Code (where adopted)
  - Local Authority Having Jurisdiction (AHJ) Published Electrical Standards and Codes

- B. Perform Work in accordance with the National Electrical Code, applicable building ordinances, and other applicable codes, hereinafter referred to as the "Code." The Contractor shall comply with the Code including local amendments and interpretations without added cost to the Owner. Where Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply unless variance is approved.
  - 1. Comply with all requirements for permits, licenses, fees and codes. The Contractor, at Contractor's expense, shall obtain all permits, licenses, fees, special service costs, inspections and arrangements required for Work under this contract, unless otherwise specified.
  - 2. Comply with requirements of the applicable utility companies serving this Project. Make all arrangements with utility companies for proper coordination of Work.

1.3 GENERAL REQUIREMENTS

- A. Guarantee: Furnish a written guarantee for a period of one (1) year from date of acceptance.
- B. Wherever a discrepancy in quantity or size of conduit, wire, equipment, devices, circuit breakers, etc., (all materials), arises on the Drawing and/or Specifications, the Contractor shall be responsible for providing and installing all material and services required by the strictest condition noted on Drawings and/or in Specifications to ensure complete and operable systems as required by the Owner and Engineer.
- C. All Core Cutting, Drilling, and Patching:
  - 1. For the installation of work under this Section, the aforementioned shall be performed under this Section of the Specifications and the Concrete section of the Specifications.
  - 2. No holes will be allowed in any structural members without the written approval of the Project's Structural Engineer.
  - 3. For penetrations of concrete slabs or concrete footings, the work shall be as directed in the Concrete Section of Specifications.
  - 4. The Contractor shall be responsible for patching and repairing surfaces where he is required to penetrate for work under this contract.
  - 5. Penetrations shall be sealed to meet the rated integrity of the surface required to be patched and repaired. The patched surface shall be painted or finished to match the existing surface.
- D. Verifying Drawings and Job Conditions:
  - 1. This Contractor shall examine all Drawings and Specifications in a manner to be fully cognizant of all work required under this Section.
  - 2. This Contractor shall visit the site and verify existing conditions. Where existing conditions differ from Drawings, adjustment(s) shall be made and allowances included for all necessary equipment to complete all parts of the Drawings and Specifications.

1.4 WORK IN COOPERATION WITH OTHER TRADES

- A. Examine the Drawings and Specifications and determine the work to be performed by the electrical, mechanical and other trades. Provide the type and amount of electrical materials and equipment necessary to place this work in proper operation, completely wired, tested and ready for use. This shall include all conduit, wire, disconnects, relays, and other devices for the required operation sequence of all electrical, mechanical and other systems or equipment.
- B. Provide a conduit only system for low voltage wiring required for control of mechanical and plumbing equipment described in this or other parts of the Contract Documents. Install all control housings, conduits and backboxes required for installing conductors and wire to the controls.
- C. Install separate conduits between each heating, ventilating and air conditioning sensing device and its control panel and/or control motor. Before installing any conduit for heating, ventilating and air conditioning control wiring, verify the exact requirements from the control diagrams provided with the equipment manufacturer's shop drawings.

1.5 TESTING AND ADJUSTMENT

- A. Upon completion of all electrical work, this Contractor shall test all circuits, switches, light fixtures, lighting control & dimming systems including distributed systems, motors, circuit breakers, motor starters and their auxiliary circuits and any other electrical items to ensure perfect operation of all electrical equipment.
- B. Equipment and parts in need of correction and discovered during such testing, shall be immediately repaired or replaced with all new equipment and that part of the system shall then be retested. All such replacement or repair shall be done at no additional cost to the Owner.
- C. All circuit(s) shall be tested for continuity and circuit integrity. Adjustments shall be made for circuits not complying with testing criteria.
- D. All test reports, including copies of any required Energy Code Acceptance Forms (e.g. CA Title 24 Acceptance for Code Compliance Forms) should be submitted to the Engineer at completion of project.

1.6 IDENTIFICATION

- A. Nameplates shall be provided for unit substations, switchgear, switchboards, distribution boards, distribution panels, panel boards, motor control centers, transformers, transfer switches, contactors, starters, disconnect switches, enclosed circuit breakers/switches, Inverters, UPSs, PDUs, RDCs, Lighting Control Panels, Dimming Panels, Door Releasing System Panels, Fire Alarm / Central Monitoring terminal cabinets/power supplies/control panels, and all low voltage system terminal & control cabinets. Nameplate inscriptions shall be identical to the equipment designations indicated in plans and specifications.

All circuit breakers/fuses in switchgear, switchboards, distribution boards, distribution panels, UPS output circuit breakers, PDU output circuit breakers and motor control centers shall have individual nameplates located immediately adjacent to the respective device. Nameplate inscription shall identify the downstream equipment or device served by the circuit breaker or fuse.

Nameplates for contactors, starters, disconnect switches, and enclosed circuit breakers shall be

engraved with the device designation/identification on the top line, source identification for the device on the 2nd line and load designation for the device on the bottom line. Where device designation is not indicated on plans/specifications, Contractor shall submit a written clarification request to the Engineer.

- B. Identification nameplates, UON, shall be laminated 1/8" thick micarta with beveled edges and engraved white letters 3/8" high, minimum, on 1-1/2" high black background for single line of text. Where two lines of text are required, provide min. 2" high nameplate. Where three lines of text are required, provide min. 2.5" high nameplate.
- C. Identification nameplates for new switchgear, switchboards, distribution boards, distribution panels, panel boards & motor control centers shall be attached with switchgear manufacturer-provided screws via switchgear manufacturer factory pre-drilled holes. A factory option to rivet identification nameplates to the equipment is only acceptable if screw-fastened nameplates are not an available option from the switchgear manufacturer. Field drilling or other mechanical attachment methods that change/void the NEMA or NTRL rating of the enclosure are strictly forbidden.
- D. Identification nameplates for transformers, transfer switches, disconnect switches, enclosed circuit breakers/switches, Inverters, UPSs, PDUs, RDCs, Lighting Control Panels, Dimming Panels, Door Releasing System Panels, Terminal cabinets and all circuit breakers/fuses in switchgear, switchboards, distribution boards, distribution panels, UPS output circuit breakers, PDUs, PDU output circuit breakers, and motor control centers shall be attached to the equipment by self-adhesive backing integral to the nameplates. When equipment is located outdoors, provide nameplates without self-adhesive backing and attach to equipment using weather-rated, UV-resistant epoxy. In all cases, clean surfaces before applying identification nameplates parallel to equipment lines.
- E. Warning Placards, as required by General Single Line Diagram Notes for multiple power sources, or Instruction Placards, as required for all kirk-key interlock schemes, all UPS bypass procedures or as required elsewhere in the plans/specifications shall be self-adhesive, 1/8" thick micarta with beveled edges, engraved 1/2" high white lettering on a Red background. Warning/Instruction Placards shall be attached to the face of the equipment directly related to the placards. Provide a formal placard submittal for review by the Engineer prior to ordering any Warning/Instruction Placards. In all cases, clean surfaces before applying Warning/Instruction Placards parallel to equipment lines.
- F. Receptacles that are part of a UL-listed under floor computer room whip assembly, ceiling and/or cable/ladder tray-mounted receptacles used in lab, manufacturing, commercial kitchen environments or that are serving telcom/data/av racks & cabinets shall have identification nameplates located on the wiring device plate cover. Nameplates shall be self-adhesive, 1/8" thick micarta with beveled edges, engraved 1/4" high white lettering on black background with serving power source, circuit identification and NEMA/IEC receptacle type. Use of two (2) separate nameplates per device plate cover is acceptable. Affix nameplates to be visible when plugs are occupying receptacles.
- G. See wiring device section of this specification for additional wiring device plate cover labeling requirements.
- H. See drawings for panel board schedule directory installation requirements.
- I. See conduit installation section of this specification for conduit labeling requirements.

1.7 FINAL INSPECTION AND ACCEPTANCE

- A. After all requirements of the Specifications and/or the Drawings have been fully completed, representatives of the Owner will inspect the work. Contractor shall provide competent personnel to demonstrate the operation of any item or system to the full satisfaction of each representative.
- B. Final acceptance of the work will be made by the Owner after receipt of approval and recommendation of acceptance from each representative.

1.8 RECORD DRAWINGS

- A. Drawings of Record: The Contractor shall provide and keep up-to-date, a complete record set of drawings. These shall be corrected daily and show every change from the original Drawings. This set of prints shall be kept on the job site and shall be used only as a record set. This shall not be construed as authorization for the Contractor to make changes in the layout without definite instruction in each case. Upon completion of the work, a set of reproducible Contract Drawings shall be obtained from the General Contractor and all changes as noted on the record set of prints shall be incorporated thereon with black ink in a neat, legible, understandable and professional manner. Refer to the Supplementary General Conditions for complete requirements.

1.9 APPROVALS, EQUALS, SUBSTITUTIONS, ALTERNATIVES, NO KNOWN EQUAL

- A. Approvals: Where the words (or similar terms) "approved", "approval", "acceptable", and "acceptance" are used, it shall be understood that acceptance by the Owner, Architect and Engineer are required.
- B. Equal: Where the words (or similar terms) "equal", "approved equal", "equal to", "or equal by", "or equal" and "equivalent" are used, it shall be understood that these words are followed by the expression "in the opinion of the Owner, Architect, and Engineer". For the purposes of specifying products, the above words shall indicate the same size, made of the same construction materials, manufactured with equivalent life expectancy, having the same aesthetic appearance / style (includes craftsmanship, physical attributes, color and finish), and the same performance.
- C. Substitution: For the purposes of specifying products "substitution" shall refer to the submittal of a product not explicitly approved by the construction documents / specifications.
  - 1. Substitutions of specified equipment shall be submitted and received by the Engineer ten (10) days prior to the bid date for review and written approval. Regulatory Agency approval for all substitutions will be the sole responsibility of the Contractor. To receive consideration, requests for substitutions must be accompanied by documentary proof of its equality with the specified material. Documentary proof shall be in letterform and identify the specified values/materials alongside proposed equal values/materials. In addition, catalog brochures and samples, if requested, must be included in the submittal. ONLY PRE-BID APPROVED PRODUCTS, ISSUED VIA A FORMAL BID ADDENDUM TO ALL BIDDERS, WILL BE ALLOWED ON THE PROJECT. REGARDLESS OF THE APPROVAL ON ANY SUBSTITUTION, ALL BIDS SHALL BE BASED ON THE PRODUCTS EXACTLY AS SPECIFIED. PRICING FOR EACH APPROVED SUBSTITUTION SHALL BE INCLUDED IN THE BID SUBMITTAL AS A SEPARATE LINE ITEM.
  - 2. In the event that written authorization is given for a substitution, after award of contract, the Contractor shall submit to the Engineer quotations from suppliers / distributors of both the specified and proposed equal material for price comparison, as well as a verification of



delivery dates that conform to the project schedule.

3. In the event of cost reduction, the Owner will be credited with 100 percent of the reduction, arranged by Change Order.
  4. The Contractor warrants that substitutions proposed for specified items will fully perform the functions required.
- D. Alternates \ Alternatives: For the purposes of specifying products, "alternatives / alternates" may be established to enable the Owner / Architect / Engineer to compare costs where alternative materials or methods might be used. An alternate price shall be submitted in addition to the base bid for consideration. If the alternate is deemed acceptable, written authorization will be issued.
- E. No Known Equal: For the purposes of specifying products, "No Known Equal" shall mean that the Owner / Architect / Engineer is not aware of an equivalent product. The Contractor will need to submit a "Substitution" item, per the requirements listed above, if a different product is proposed to be utilized.

#### 1.10 SHOP DRAWINGS / SUBMITTALS

- A. Shop Drawings / Submittals shall be submitted in six (6) bound sets accompanied by Letter of Transmittal, which shall give a list of the number and dates of the drawings submitted. Drawings shall be complete in every respect and bound in sets.
- B. The Shop Drawings / Submittals submitted shall be marked with the name of the project, numbered consecutively and bear the approval of the Contractor as evidence that the Contractor has checked the Drawings. Any Drawings submitted without this approval will be returned to the Contractor for resubmission.
- C. If the shop drawings show variations from the requirements of the Contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in the Contractor's letter of transmittal. If the substitution is accepted, the Contractor shall be responsible for proper adjustment that may be caused by the substitution. Samples shall be submitted when requested.
- D. Only products listed as "Equal" within the contract documents, along with formally approved "Substitutions" will be reviewed. Products not conforming to these items will not be reviewed and will be returned to the Contractor for re-submittal.
- E. Review comments used in response to shop drawings / submittals are:
- "No Exception Taken" Product approved as submitted.
  - "Furnish As Corrected" Re-submittal not required, although the Contractor shall provide the submitted product with corrections as noted.
  - "Revise And Resubmit" Re-submittal required with corrections as noted.
  - "Rejected" Re-submittal required based upon the originally specified product.
- F. Shop drawings shall be submitted on the following but not limited to:

- Lighting Fixtures, Lamps and Ballasts.
- Switchgear, Switchboards, Distribution Boards, Motor Control Centers, Panel boards, and Bus Ducts; complete with overcurrent device information.
- Transformers.
- Fire alarm System/Central Monitoring System.
- Wiring Devices.
- Lighting Control System / Dimming System Products.
- Pullboxes and Underground Vaults
- Terminal Cabinets
- Lighting Inverters, UPSs, RDCs, PDUs, Generators, Transfer Switches, TVSS Systems
- Cable Tray, Flexible Cable tray and Cable Runway
- Power Poles and Floor Boxes
- Arc Flash, Short-Circuit & Coordination studies
- All other products called out on drawings that call for shop drawing submittal.

1.11 MAINTENANCE, SERVICING, INSTRUCTION MANUALS AND WIRING DIAGRAMS

- A. Prior to final acceptance of the job, the Electrical Contractor shall furnish to the Owner at least four (4) copies of operating and maintenance and servicing instructions, as well as four (4) complete wiring diagrams for the following items or equipment:
- Lighting Control System / Dimming Systems.
  - Fire alarm system.
  - Transformers.
  - Switchgear, Switchboards, Distribution Boards, Motor Control Centers, Panel boards, and Bus Ducts; complete with over current device information.
  - Lighting Inverters, UPSs, PDUs, Generators, Transfer Switches, TVSS Systems
- B. All wiring diagrams shall specifically cover the system supplied. Typical drawings will not be accepted. Four (4) copies shall be presented to the Owner.

1.12 INTERRUPTION OF SERVICE OR SERVICE SHUTDOWN:

- A. Any interruption of electrical services, electrical circuits, electrical feeders, signal systems, communication systems, fire alarm systems, etc. required to perform work shall meet the specific prior-approval requirements of the Owner. Such work shall be scheduled with the Owner to be performed at the Owner's convenience.
- B. Interruptions/outages of any of the Owner's systems and services mentioned above shall be scheduled to occur during other than the Owner's normal business hours. Any overtime costs shall be borne by the Contractor.
- C. See drawings for any additional requirements regarding outages, interruption and any temporary services required.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials and Equipment: All electrical materials and equipment, including custom-made

equipment, shall be new and shall be listed by Underwriter's Laboratories (UL) and bear their label or be listed and certified by a Nationally Recognized Testing Lab (NRTL) that is also recognized by the local Authority-Having-Jurisdiction (AHJ).

B. Switchgear /Switchboards / Distribution Boards / Motor Control Centers:

1. See general single line notes on single line drawing for more information.

C. Panel boards - Branch Circuit:

1. See drawings for requirements and panel board schedules; and Specification Section 26 24 16 for additional requirements.

D. Lighting Fixtures:

1. See drawings for lighting fixture and lamp schedules and additional specifications. Furnish, install and connect a lighting fixture at each outlet where a lighting fixture type symbol (designated on plans) is shown as being installed. Each fixture shall be complete with all required accessories including sockets, glassware, boxes, spacers, mounting devices, fire rating enclosure and lamps.
2. LED Drivers: See lighting fixture schedule notes. All noisy driver shall be replaced at no cost to the Owner.
3. Lamps: See lamp / fixture schedule and lamp / lighting fixture schedule notes.

E. Wiring Devices:

1. Provide wiring devices indicated per plan. Devices shall be specification grade. Acceptable manufactures are Leviton, Arrow-Hart and Hubbell. Provide all similar devices of same manufacturer, unless indicated otherwise. All device colors shall be from the full range of manufacturer standard color options as selected by the Architect. This selection will be made during the shop drawing review process
2. Receptacles:
  - a. Duplex receptacles shall be specification grade, 20 amperes, 125 volts, 3 wire, side wired with binding screws, parallel slots, U-ground, plaster ears and captive mounting screws. Body shall be phenolic, plastic or bakelite. Receptacles shall be heavy duty, 3-blade current carrying contacts and double wide flat blade ground contacts. Receptacles shall be Arrow-Hart 5242-I, Hubbell 5242-I or Leviton 5242-I or approved equal.
  - b. Single receptacles shall be specification grade, grounding type, side wired, with binding screws, receptacles shall have standard size ivory bakelite base. For circuits consisting of one single receptacle only, ampere rating of receptacle shall be the same as circuit breaker or fuse. 20 ampere, 125 volt receptacles shall be NEMA 5-20R, Arrow-Hart 5721-I.
  - c. Kiln receptacles and range receptacles shall be 3-pads, 4-wire, grounding type, rated 50 amperes at 125/250 volts, polarized, Arrow-Hart #5754, and shall be provided with a 2-gang, stainless steel plate, Arrow-Hart #9336.

- d. Dryer receptacles shall be 3-wire, non-grounding type, rated 30 amperes at 125/250 volts, polarized, with "L" shaped and angled straight contacts and ivory bakelite base, Arrow-Hart #9344N with a 2-gang stainless steel plate Arrow-Hart S703.
- e. Ground fault interrupter type receptacles shall consist of a single receptacle and reset device manufactured in a standard configuration for use with a duplex plate. Receptacles shall be feed-thru, 20 ampere, NEMA 5-20R, ivory in color and shall be Leviton 6399-I, or equal. Exterior mounted receptacles shall be weatherproof.
- f. Tamper resistant receptacles shall be 20 amp, 125 volts, Hubbell Cat. No. HBLSG62HI, Nema 5-20R.

F. Switches:

1. Local Switches:

- a. Local switches shall be tumbler type, specification grade, rated 20 amperes at 120-277 volts AC only, with plaster ears, binding screws for side wiring, and standard size composition cups which fully enclose the mechanism. Switches shall be approved for use at currents up to the full rating on resistive, inductive, tungsten filament lamp and fluorescent lamp loads, and for up to 80% of the rating for motor loads. Switches shall be single pole, double pole, 3-way, 4-way, non-lock type. Non-lock type switches shall have ivory handles, and switch shall be Hubbell HBL 1221-I single pole, HBL 1222-I double pole, HBL 1223-I 3-way, and HBL 1224-I 4-way.
- b. All lock type switches shall have metal or nylon key guides with ON/OFF indication, and shall be operable by the same key. Key switches shall be Hubbell 1209
- c. Rotary lock switches shall incorporate a tumbler type lock to prevent unauthorized operation. Lock shall be tumbler type by P & F Corbin, keyed to a HH41 key. Lock switch shall be installed with pin tumblers facing downward. Key shall be removable in all positions. Each device shall be complete with 2 keys. Keys shall be delivered only to the District's Electrical Inspector. Switches shall be rated at 20 amperes, 120-277 volt AC. Switches shall be as follows: single pole switches shall be Arrow-Hart 1191; double pole switches shall be Arrow-Hart 1192; 3-way switches shall be Arrow-Hart 1193. Switch plates shall be of stainless steel, engraved with "ON" and "OFF" positions. Switch plates shall be Arrow-Hart 1187. For switch plates of 2 or more gangs, provide special order plates equal to the single gang plate.
- d. Pilot light switches shall be rated 20 amps and shall conform to the specifications for "local switches". The switches shall have red, rugged "Lexan" handles that are lighted by long-lasting neon lamps. Pilot light shall light when load is on. Single pole, 120 volt switches shall be Hubbell HBL1221-PL. Single pole, 277 volt switches shall be Hubbell HBL1221-PL7.
- e. Remote control switches for mechanically held contactors arranged for 3-wire

control shall be tumbler type, momentary contact, single pole, 3-position with center "OFF", rated 20 amperes at 120-277 volts AC only, with plaster ears, binding screws for side wiring, standard size composition cups which fully enclose mechanism, and ivory handles; Hubbell HBL1556-I.

2. The following device plates shall be engraved:
  - a. Key operated switches, switches with Pilot Lights and Switches for the control of motors, heaters and ventilators. Engraving shall be black and occur on the exposed side of the plate and indicate the motor, heater, or ventilator controlled.
  - b. Receptacles on generator and/or UPS power shall have custom stamped plates with the words "Generator" or "UPS" in black letters.
3. Weatherproof Outlet Covers/Assemblies. All Receptacles identified as weatherproof on the drawings shall be GFCI type and equipped as follows:
  - a. Subscript WP-A: Recessed wall box, 6" x 6"x 5 1/2" deep, with a hinged, lockable, cast aluminum, self-closing, gasket-equipped door that is wet location-listed raintight while-in-use. Unit shall comply with NEC, or CEC where adopted, Article 406.8(A) and (B). C.W. Cole TL-310-9-GFI-PH-MOD-CUSTOM COLOR Series with an interior metal plate suitable for a GFCI receptacle in one compartment separated from a second compartment with a metal separation barrier. The second compartment shall have a blank metal plate suitable for field installation of power, AV or communications devices. This compartment shall have a minimum 3/4" C.O. with pull string routed from the box to the facility telephone backboard unless otherwise noted on the drawings. Provide 1 key minimum per device to the Owner's project manager upon completion of project. Include all costs for custom color powder coat finish as selected by Architect.
  - b. Subscript WP-B: Wet location-listed raintight while-in-use cast copper-free aluminum lockable cover with baked aluminum lacquer finish and one gang GFCI receptacle. Hubbell WP26M series. Polycarbonate covers are unacceptable. Unit shall comply with NEC, or CEC where adopted, Article 406.8(A) and (B). Contractor shall field paint custom color as selected by Architect.
  - c. Subscript WP- C: Single Service BK Lighting #CUS-1204-46 raintight while-in-use cast copper-free aluminum lockable cover with baked aluminum lacquer finish and one-gang GFCI receptacle. Hubbell WP26M series or equal. Polycarbonate covers are unacceptable. Wet location-listed weatherproof cover shall comply with NEC, or CEC where adopted, Article 406.8(A) and (B). Contractor shall provide custom color by manufacturer as selected by Architect. See drawings for additional details.
  - d. Subscript WP-D: Dual Service BK Lighting #CUS-1204-47 with raintight while-in-use cast copper-free aluminum lockable cover(s) with baked aluminum lacquer finish, internal barrier, one gang GFCI receptacle and one gang telecommunications outlet. Hubbell WP26M series. Polycarbonate covers are unacceptable. Wet location-listed weatherproof cover(s) shall comply with NEC, or CEC where adopted, Article 406.8(A) and (B). Contractor shall provide custom color by manufacturer as selected by Architect. See drawings for additional details.

- G. Motor Controllers / Starters: See drawings for motorized equipment schedules and specifications.
- H. Circuit Breakers:
1. Service entrance circuit breakers smaller than 400 Amp frame shall be thermal-magnetic trip with inverse time current characteristics unless otherwise indicated below. Service entrance main circuit breakers, 400 Amp frame and larger shall be 100% rated, solid-state type as outlined in this specification. All other service entrance circuit breakers, 400 Amp frame and larger, shall be 100% rated, solid-state type as outlined in this specification.
  2. All non-service entrance circuit breakers 225 Amp and larger shall be thermal magnetic type and have continuously adjustable magnetic pick-ups of approximately 5 to 10 times trip rating. Breakers shall have easily changed trip rating plugs with trip ratings as indicated on the Drawings. Rating plugs shall be interlocked so they are not interchangeable between frames. Additionally, all non-service entrance circuit breakers, 600 Amp frame and larger, located in 480v 3 phase, 3-wire or 277/480v, 3 phase 4-wire switchgear, distribution boards or panel boards, shall be solid state, 100% rated. Breaker shall have built-in test points for testing long delay and instantaneous, and ground fault (where shown) functions of the breaker by means of a 120-volt operated test kit. Contractor shall utilize a test kit capable of testing all breakers 400 Amp and above - at the Engineer's request.
  3. All non-service entrance circuit breakers less than 225 Amp shall be molded plastic case, air circuit breakers conforming to UL 489. Provide breakers with thermal magnetic trip units, and a common trip bar for two- or three-pole breakers, connected internally to each pole so tripping of one pole will automatically trip all poles of each breaker. Provide breakers of trip-free and trip-indicating bolt-on type, with quick-make, quick-break contacts. Provide single two- or three-pole breaker interchangeability. Provide padlocking device for circuit breakers as shown on the Drawings.
  4. Where a Current Limiting Circuit Breaker (CLCB) is indicated on drawings or as required elsewhere in this specification, provide a U.L. listed current limiting thermal magnetic circuit breaker(s) u.o.n. An independently operating limiter section within a molded case is not allowed. Coordinate CLCB ratings as required to protect electrical system components on the load side of the CLCB to include, but not limited to, protecting automatic transfer switches, panel boards and lighting control panels.
  5. Where a solid-state circuit breaker is indicated on drawings or as required elsewhere in this specification, provide a solid-state circuit breaker with minimum five function complete with built-in current transformers. The five functions shall be independently adjustable and consist of Overload/Long Time Amp Rating, Long Time Delay, Short Time Delay, Short Circuit/Instantaneous Pickup, but may also include Shunt Trip and/or Ground Fault if so indicated on the Drawings. Rating plugs shall be interlocked so they are not interchangeable between frames. Breaker shall have built-in test points for testing long delay and instantaneous, and ground fault (where shown) functions of the breaker by means of a 120-volt operated test kit. Contractor shall utilize a test kit capable of testing all breakers 400 Amp and above - at the Engineer's request.
  6. Ground Fault Interrupting Breakers. Provide with molded plastic case, air circuit breakers, similar to above with ground fault circuit interrupt capability, conforming to

UL Class A, Group 1.

7. Arc Fault Interrupting Breakers. Provide with molded plastic case, air circuit breakers, similar to above with arc fault circuit interrupt capability, conforming to UL 1699 & UL Class A, Group 1. Provide on all-dwelling unit circuits supplying bedrooms, sleeping quarters etc as required to comply with NEC, or CEC where adopted, Article 210.12(B).
8. Tandem or half-sized circuit breakers are not permitted.
9. Series Rated Breakers. UL listed series rated combinations of breakers can be used to obtain panelboard-interrupting ratings shown on Drawings. If series rated breakers are used, switchboards, distribution boards and panel boards shall be appropriately labeled to indicate the use of series rated breakers. Shop drawing submittal shall include chart of U.L. listed devices, which coordinate to provide series rating.
10. Circuit breakers shall be standard interrupting construction. Panelboard shall accept standard circuit breakers up to 225 amperes.
11. Circuit breaker handle accessories shall provide provisions for locking handle in the on or off position.
12. Shunt trip equipped circuit breakers shall be provided on all elevator feeders.
13. Temperature compensating circuit breaker(s) shall be provided when located in outdoor enclosure(s) or when located in an enclosure subject to high ambient heat due to nearby industrial processes etc.
14. Provide 75 degree Celsius-rated conductor lugs/lug kits as required on all circuit breakers to accept conductor quantities and sizes shown on drawings.
15. All circuit breaker terminations shall be suitable for use with 75 degrees Celsius ampacity conductors.

I. Disconnect Switches:

1. Non-fusible or fusible, heavy-duty, externally operated horsepower-rated, 600V A.C. Provide NEMA 3R, lockable enclosures for all switches located on rooftops, in wet or damp areas and in any area exposed to the elements.
2. Fusible switches shall be Class "R".
3. Amperage, Horsepower, Voltage and number of poles per drawings- all of which shall be clearly marked on the switch nameplate.
4. Provide the Owner's project manager with one (1) spare set of fuses and two (2) sets of fuse clips/fuses for every set of fuses on the project.

J. Fuses:

1. Provide fuses at all locations shown on the Drawings and as required for supplemental protection.

- a. Fuses shall be manufactured by Bussman, Shawmut, or equal.
  - b. All fuses shall be the product of a single manufacturer.
- 2. Main and Feeder Protection.
  - a. Where rating of protective device is greater than 600A, provide Bussman Hi-Cap fuses, Class L, current limiting, having an interrupting rating of 200,000A RMS.
  - b. Where rating of protective device is 600A or less, provide Bussman Class RK series current limiting fuses, having an interrupting rating of 200,000A RMS.
- 3. Motor Protection.
  - a. Where rating of protective device is greater than 600A, provide Bussman Hi-Cap fuses, Class L, current limiting, having an interrupting rating of 200,000A RMS.
  - b. Where rating of protective device is 600A or less, provide Bussman Class RK series current limiting fuses, having an interrupting rating of 200,000A RMS.
  - c. Where fuses feeding motors are indicated but not sized, it shall be the responsibility of the Contractor shall coordinate the fuse size with the motor to provide proper motor running protection.
  - d. When rejection type fuses are specified (Class RK series) the fuse holder of all switches (specified in other Sections) shall be suitable for the fuses provided.
- K. Cable Tray, Flexible Cable Tray and/or Cable Runway:
  - 1. See drawings for Cable Tray, Flexible Cable Tray and/or Cable Runway specifications.
- L. Lighting Control / Dimming Systems:
  - 1. See drawings for lighting Control and/or Dimming Systems schedules and specifications.
  - 2. Wall box dimmers shall be rocker-type as manufactured by Lutron - no known equal. Dimmers and dimmer faceplates shall match the color of adjacent switches and faceplates. Dimmers and dimmer faceplates in wood finished areas shall generally be black unless otherwise indicated by the Architect. The Contractor shall obtain written approval of the Architect regarding final dimmer and dimmer faceplate color selection prior to ordering material. Multiple dimmers/switches shall be ganged together with a common cover plate. Provide dimmers as follows:
    - a. Incandescent: Lutron DIVA DV-10P or DV-103P (3-way) (1000 Watt max.)
    - b. Electronic Low Voltage: Lutron DIVA DVELV-300P or DVELV-303P-(3-way) (300 Watt)



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- c. Magnetic Low Voltage: Lutron DIVA DVLV-10P or DVLV-303p (3-way) (800 Watt max.)
- d. Fluorescent (3-Wire): Lutron DIVA DVF-103P (single/3way, 8A @ 120v) or DVF-103P-277 (single/3way, 6A @ 277v)
- e. Fluorescent (0-10V): Lutron DIVA MW-DV.
- f. Fluorescent (LutronTu-Wire): Lutron DIVA DVFTU-5A3P with Lutron H.P. module where required.
- g. Fan Control: Lutron DIVA DVFSQ-F (1.5A @ 120V. max, 3 speed, single pole, 3-way)

Contractor shall verify if dimmer(s) requires derating when ganged. Provide Lutron H.P. module, Lutron Power Boosters, and/or Lutron Interfaces where required to accommodate loads higher than dimmers' standard or derated load carrying capacity. .

M. Fire Alarm System/Central Monitoring System:

- 1. See drawings for Fire Alarm System or Central Monitoring System specifications.

Q. Fire Alarm, Clock, Security Intrusion Detection, Public Address, and Telephone Systems wiring shall be continuous from terminal cabinets or from equipment to each device. Splices are not allowed between devices and/or terminal cabinets at junction and pull boxes. Wiring shall be terminated at approved terminal blocks only.

R. All systems of wiring shall be so installed that, when completed, systems will be free from short circuits and grounds, other than required grounds. Electrical contractor shall include in his bid cost of services an approved independent testing laboratory to test all feeders insulation resistance.

The tests to be performed are as follows:

- 1. With a megger insulation tester, use the time-resistance method (Sometimes referred to as absorption test) to test each feeder and branch circuit wire. Tests must be conducted with wire disconnected at each end in order to test the wire itself. A second test must be conducted with the wire connected at each end and the circuit breakers or switches in the closed positions.

- 2. Tests shall be performed in presence of the District Electrical Inspector.

Three copies of the test results shall be submitted to the District Electrical Inspector. Test results shall be submitted on an official form from the independent testing laboratory showing project location, test engineer, test conditions, test equipment data, and final test results.

S. Outlet Boxes and Fittings:

- 1. Outlet boxes used in concealed work shall be galvanized steel, pressed or welded type, with knockouts.
- 2. In exposed work, outlet boxes and conduit fittings required where conduit runs change

direction or size, shall be cast metal with threaded cast hubs cast integral with box or fitting. Boxes and fittings shall not have unused spare hubs except as otherwise indicated or specified.

3. Fittings shall be cast metal and non-corrosive. Ferrous metal fittings shall be cadmium plated or zinc galvanized. Castings shall be true to pattern, smooth, straight, with even edges and corners, of uniform thickness of metal, and shall be free of cracks, gas holes, flaws, excessive shrinkage and burnt-out sand.
4. Covers for fittings shall be galvanized steel or non-corrosive aluminum and shall be designed for particular fitting used.
5. Light fixture outlets shall be 4" octagon, 4" square, 2 1/8" deep or larger, depending upon number of wires or conduits therein, and shall be equipped with 3/8" malleable iron fixture studs, and plaster rings. Plaster rings shall have round opening with 2 ears drilled 2-23/32" center to center.
6. For local switch outlets use 4" square 2 1/8" deep, boxes for single gang, 5" square boxes for two-gang, and special solid gang boxes with gang plaster ring for more than 2 switches.
7. For all receptacle, clock, bell, fire alarm pull station, speaker, thermostat, telephone, and data outlets, use 4" square, 2 1/8" deep boxes or larger, if necessary, with single gang plaster rings. For television outlets, use 4-gang deep boxes and 4-gang plaster rings.
8. Plaster rings shall be provided on all flush mounted outlet boxes except where otherwise indicated or specified. All plaster rings shall be same depth as finished surface.
9. In existing plywood wall or drywall construction, and where flexible steel conduit is fished into walls, one-gang and two-gang outlets for wiring devices may be sectional steel boxes with plaster ears. Boxes shall be fastened to plywood with a flat head screw in each plaster ear screw hole.
10. Factory made knock-out seals shall be installed to seal all box knock-outs which are not intact.
11. At each location where flexible conduit is extended from a flush outlet box, provide and install a weather-proof universal box extension adapter.

T. Junction and Pull-Boxes:

1. Junction and pull-boxes, in addition to those indicated, shall only be used where absolutely necessary with specific direction of the District's Electrical Inspector in each case.
2. Interior and non-weatherproof boxes shall be constructed of blue or galvanized steel with ample laps, spot welded, and shall be rigid under torsional and deflecting forces. Boxes shall have auxiliary angle iron framing where necessary to ensure rigidity. Covers shall be fastened to box with a sufficient number of brass machine screws to ensure continuous contact all around. Flush type boxes shall be drilled and tapped for cover screws at Site if boxes are not installed plumb. All surfaces of pull and junction boxes and covers shall be given one coat of metal primer, and one coat of aluminum paint.
3. Weatherproof pull and junction boxes shall conform to foregoing for interior boxes with

following modifications: Cover of flush mounting boxes shall have a weather-tight gasket cemented to and trimmed even with cover all around. Surface or semi-flush mounting pull and junction boxes shall be UL approved as rain-tight and shall be complete with threaded conduit hubs. All exposed portions of boxes shall be galvanized and finished with a prime coat and coat of baked-on gray enamel.

4. All junction and pull-boxes shall be rigidly fastened to the structure and shall not depend on conduits for support.
5. Underground Concrete Pull Boxes:
  - a. Precast Concrete Pull Boxes. Concrete pull boxes shall be traffic type, reinforced for H-20 Traffic bridge loading, Precast concrete. Pull boxes with inside dimensions 2'-0"x 3'-0" x 3'-0"D shall consist of a base section, top ring and cover. Base section shall have two 10"x10" knockouts in each 3'-0" side, and one 20"x20" knockout in each 2'-0" side. Pull boxes with inside dimension 4'-0" x 4'-0" x 4'-0"D shall consist of a base section, mid section, topping, and cover. Base section shall have two 8"x 16" knockouts on each of two opposite sides, and one 20" x 20" knockout on each of the other two opposite sides. All pull boxes shall have a minimum of 6" diameter sump knockout, and 1" diameter ground rod knockout. In each pull box, furnish and install cable racks on walls. Each rack shall be equipped with 3 porcelain cable holders on a vertical steel mounting bar. Each pull box shall have 3/4" diameter pull irons. Covers shall be traffic type consisting of steel safety plate bolted to frame. Covers shall be marked "Electrical", "Power" "Telephone", "Signal" or "Ground", as required. Pull boxes shall be as manufactured by Quickset, or approved equal.
  - b. Provide end bells in all duct entrances. Terminate each metal conduit with insulated bushing having grounding terminal, O.Z. Type "Big".
  - c. Place pulling irons on opposite walls and below horizontal centerlines of ducts and bricked-up openings, and in bottom. Install pulling irons with each end hooked around a reinforcing bar.
  - d. Install a floor drain in every concrete pullbox into a sump containing 10 cubic feet of 1" crushed rock; minimum size 48" deep and 36" diameter. Provide 36" length of tile pipe extending down into the sump. Provide a grille over the top opening of pipe.
  - e. Install a 3/4" diameter, 10'-0" copperweld steel ground rod in every power concrete pull-box. Locate near a wall with 6" projection above floor for ground clamps. Permanently and effectively ground all metal equipment cases, cable racks, etc., in all pull boxes.
  - f. Provide a 6" deep sand base under each pull box.
  - g. Identify all power and signal cables by tagging in all manholes and pull boxes. Tie securely to cables with nylon cord or insulated type TW wire. Tie so that turns of wires do not form a closed electrical circuit.
  - h. Top of steel plate shall have a minimum coefficient of static friction of 0.5 for either wet or dry conditions, when tested for any shoe sole material. Testing and

certification of the friction factor shall be conducted by an independent testing laboratory approved by the engineer, under the direction of a registered Civil or Quality Engineer. Testing shall conform to ASTM D1047 or F489 or F609, or other procedure approved by the Engineer.

6. Underground utility boxes shall be reinforced concrete with non-setting shoulders to prevent settlement following installation. Boxes shall be furnished with cast iron cover with finger hole, size as indicated on Drawings. Utility boxes shall be as manufactured by Quickset, or approved equal.
  7. Manholes, vaults and pull-boxes required by utility company, and installed by Electrical Contractor, shall meet all requirements of utility company.
- U. Plywood Backboards: Where indicated for telephone or communications system terminals or other equipment assemblies, provide backboards of size indicated. Use 3/4" thick x 8' tall (length per plans), Douglas Fir, void-free, kiln-dried, fire-rated plywood finished on one side and prime coat painted on all surfaces with finish coat of enamel paint, color by Architect. Leave one (1) fire-rating stamp/sheet exposed for inspection.
- V. Terminal Cabinets:
1. Terminal cabinets shall be fabricated of hot dipped galvanized code gauge sheet metal for flush or surface mounting, complete with barriered sections, a door for each vertically barriered section and sizes as indicated on plan. Doors shall be hinged and lockable. Locks shall be keyed to match the branch circuit panelboards. Terminal cabinet trims shall match the branch circuit panels.
  2. Provide each terminal cabinet with a full size plywood backboard.
  3. Terminal cabinets shall be installed complete with full-length skirts of the same construction and finish as the terminal cabinet.
  4. Where mounted outdoors, terminal cabinets shall be NEMA 3R, weatherproof complete with gaskets and required sealant to prevent moisture from entering the terminal cabinet.
  5. All terminal cabinets and terminal cabinet barriered sections shall be labeled by the cabinet or cabinet section use (i.e. CATV, Security, etc). Labels shall be Micarta type as specified elsewhere in these specifications. Unless otherwise noted, all termination blocks and cables shall be labeled per ANSI/EIA 606 standard.
- W. Painting: Terminal cabinets, panels, junction boxes, pull boxes, etc., and conduit installed in public view shall be painted with colors selected by the Architect to match the subject surface. Refer to painting section of the specifications for additional requirements.
- X. Seismic Design and Anchoring of Electrical Equipment:
1. Seismic Protection Criteria: All Electrical and Mechanical machinery installations provided, as part of this contract located in any Seismic Risk Zone of the Uniform Building Code Seismic Risk Map shall be protected from earthquakes in accordance with the International Building Code and, as applicable, the state and local building codes and regulations. Protection criteria for these zones shall be a Horizontal Force Factor as

prescribed by the IBC, or locally adopted building codes, multiplied by the machinery weight considered passing through the machinery center of gravity in any horizontal direction. Unless vibration isolation is required to protect machinery against unacceptable structure transmitted noise and/or vibration, machinery shall be protected from earthquakes by rigid structurally sound attachment to the load supporting structure. The force factor and anchorage shall be determined by calculations performed and submitted to the Architect by a professional engineer registered in state where the work is being performed (civil or structural) hired by the Contractor. The Contractor shall be responsible for the design of seismic restraint systems for all pieces of equipment weighing over 50 pounds including but not limited to the following:

- a. Switchgear, Switchboards, Distribution Boards, Motor Control Centers, and Panel boards.
  - b. Conduits/Conduit support trapezes
  - c. Transformers
  - d. Light Fixtures
  - e. Inverters, UPSs, RDCs, PDUs, Generators, Transfer Switches
  - f. Cable Tray, Flexible Cable Tray, Ladder Tray
  - g. Bus Duct
2. Seismic protection, labor, materials and design shall be included in the Contract sum.
- Y. Trenching and Backfilling: Contractor shall be responsible for trenching and backfilling. Refer to Trenching and Backfilling section of the specifications for complete requirements.

### PART 3 - EXECUTION

#### 3.1 PREPARATION AND INSTALLATION

- A. Installation of Conduit and Outlet Boxes:
1. All conduit installed in the dry walls or ceilings of a building shall be steel tube (EMT), aluminum tube (EMT), or Intermediate Metal Conduit (IMC). Flexible conduit shall not be used in lieu of EMT, IMC or rigid conduit except as noted herein.
  2. Galvanized rigid conduit (GRC) or intermediate metal conduit (IMC) shall be used as follows:
    - when noted on the drawings.
    - when considered exposed to damage by the local AHJ.
    - when installed in wet or damp locations and of a trade size where listed-raintite fittings, connectors, couplings etc. are unavailable.
    - when required by NEC or CEC Article 517.13.
    - when installed in concrete and masonry. The use of ENT in CMU walls and parking structures may be allowed only as directed in writing by the Engineer. Request for ENT substitution must be made prior to bid and in accordance with pre-bid substitution requests requirements of these specifications.

3. Intermediate metal conduit (IMC), is approved for use in all locations as approved for GRC or EMT and in accordance with NEC, or CEC where adopted, Article 342.
4. Flexible steel conduit shall only be permitted to be used at light fixture outlets and connections to vibrating electrical equipment. All flexible steel conduit runs shall be less than 6'-0". All outdoor installation shall be made using liquid-tight flex with approved fittings. Include a separate insulated green ground conductor sized per NEC in each conduit. Other uses of flexible conduit shall be allowed only as approved in writing by the Engineer.
5. Flexible liquidtight conduit shall be installed in lieu of the flexible steel; where required by the NEC, or CEC where adopted, in damp and wet location, where exposed to weather, in refrigerated area (65°F or less), and/or between seismic joints. All rotating electrical equipment shall be supplied with flexible, liquid-tight conduit with appropriate slack and shall not exceed thirty-six (36) inches. Include a separate insulated green ground conductor sized per NEC in each conduit. Other uses of liquidtight flexible conduit shall be allowed as approved in writing by the Engineer on a case by case basis.
6. Rigid metallic conduit installed underground or embedded in concrete shall be 1" trade size minimum and shall be wrapped with 20 mil polyvinyl chloride plastic tape, PVC conduit installed underground or embedded in concrete shall be 3/4 " minimum trade size.
7. Where required for providing an Electrical Circuit Protective System to comply with NEC, or CEC where adopted, Articles 695 and 700, utilize UL listed 2-hour fire-rated, RHH-RHW conductors in conduit.
8. Conduit shall be run so as not to interfere with other piping fixtures or equipment.
9. The ends of all conduits shall be cut square, carefully reamed out to full size and shall be shouldered in fitting.
10. No running threads will be permitted in locations exposed to the weather, in concrete or underground. Special union fittings shall be used in these locations.
11. Where conduit is underground, under slabs or grade, exposed to the weather, or in wet locations, make joints liquid tight and gas tight.
12. All metal conduit in masonry and concrete and where concealed under floor slabs shall have joints painted with thread compound prior to makeup.
13. PVC conduit shall not be run in walls.
14. Where conductors enter a raceway or a raceway in a cabinet, pull box, junction box, or auxiliary gutter, the conductors shall be protected by a plastic bushing type fitting providing a smoothly rounded insulating surface.
15. Where conduit extends through roof to equipment on roof area, this Contractor shall provide flashing material compatible with the roofing system as required by the roofing specifications or as required by the Owner's roof warranty. This flashing shall be delivered to the roofing contractor for installation. The actual location of all such roof penetrations

and outlets shall be verified by the Architect/Owner. Contractor shall verify type of flashing prior to bid and include all costs.

16. All conduit shall be supported at intervals not less than 6'-0" and within 12" from any outlet and at each side of bends and elbows. Conduit supports shall be galvanized, heavy stamped, two-hole conduit clamp properly secured.
17. Where conduit racks are used the rack shall consist of two piece conduit clamps attached to galvanized steel slotted channels, properly secured via threaded rods attached directly to the building structure.
18. Nail-in conduit supports, one-piece set screw type conduit clamps or perforated iron for supporting conduit shall not be used.
19. Seismic Conduit Support:
  - a. All conduit shall be supported in such a manner that it is securely attached to the structure of the building. Attachment is to be capable of supporting the tributary weight of conduit and contents in any direction. Maximum spacing of support and braces are to be as follows:

<u>CONDUIT SIZE</u>	<u>MAXIMUM SPACING</u>
1/2" to 3"	6'-0"
3-1/2" to 4"	8'-0"

20. All conduit runs shall be installed parallel or perpendicular to walls, structural members, or intersection of vertical planes and ceilings. Field made bends and offset shall be avoided where possible. Crushed or deformed raceway shall not be installed.
21. Open knockouts in outlet boxes only where required for inserting conduit.
22. Locate wall outlet of the same type at same level in all rooms, except where otherwise noted.
23. Outlet boxes on metal studs shall be attached to metal hangers, tack welded or bolted to studs; on wood studs attachment shall be with wood screws, nails not acceptable.
24. Recessed boxes shall not be mounted back-to-back in any wall; minimum offset shall be 24 inches.
25. Junction Boxes that do not contain any device(s) shall be located in storage rooms, electrical closets, or above accessible ceilings, not in hard lid ceilings or other forms of inaccessible ceilings. Place boxes which must be exposed to public view in a location approved by the Owner's Project Manager. Provide covers or plates to match adjacent surfaces as approved by the Owner's Project manager.
26. Surface mounted pull boxes, terminal cabinets, junction boxes, panel boards etc., shall be attached to walls using appropriate screws, fasteners, backing plates, stud blocking etc., as detailed on Architectural and/or Structural drawings. If architectural and/or Structural drawings are not provided on the Project, Contractor shall provide all necessary mounting hardware and backing support to comply with local building code requirements and any

additional requirements imposed by the local Authority-Having-Jurisdiction.

27. Except where below grade, sleeves shall be installed where conduit passes through masonry or concrete walls and shall be 24 gauge galvanized steel no more than 1/2" greater in diameter than the outside diameter of the conduit. When located in non-rated structures, caulk conduit sleeve with stone wool. When located in fire rated structures, provide U.L. listed fire stopping system. See fire stopping section of this specification for additional requirements.
28. All boxes shall be covered with outlet box protector, Appleton SB-CK, or similar device / method to keep dirt / debris from entering box, conduit or panels. If dirt / debris does get in, it shall be removed prior to pulling wires.
29. All boxes installed outdoors shall be suitable for outdoor installations, gasketed, screw cover and painted as directed by the Architect with weatherproof paint to match building.
30. All conduit entries to outdoor mounted panels, cabinets, boxes, etc., shall be made using Myers "SCRU-TITE" hubs Series ST.
31. Provide nylon or a 1/8-inch O.D. polyethylene rope, rated at 250 pounds tensile strength, in all conduits more than 5 feet in length left empty for future use. Not less than 5 feet of rope shall be left at each end of the conduit. Tag all lines with a plastic tag at each end indicating the termination/stub location of the opposite end of the conduit.
32. All multiple conduit runs within suspended ceilings shall be suspended from building structure by means of unistrut hangers/racks, Conduit shall not be allowed to lay on ceiling or be supported from ceiling suspension wires or other suspension system. Support conduit to structure above suspended ceilings 8" minimum above ceiling to allow removal of ceiling tile. Maintain two-inch clearance above recessed light fixtures
33. All exposed conduits and support hardware shall be painted to match the finish of the wall or ceiling to which it is supported.
34. Where conduits or wireways cross seismic joints, provide approved flexible conduit connection or approved expansion/deflection fitting to allow for displacement of conduit in all three axes. Connection shall allow for movement in accordance with design of seismic joint. Non-flexible raceways crossing expansion joints or other areas of possible structural movement shall make provision for 3-way movement at such points by means of expansion/deflection fittings. Fittings shall be installed in the center of their axes of movement and shall not be deflected to make part of a conduit bend, or compressed or extended to compensate for incorrect conduit expansion/deflection fittings(s) complete with ground jumpers.

Where necessary, provide approved expansion joints to allow for thermal expansion and contraction of conduit(s). Install expansion joints complete with ground jumpers.

35. Seal all conduits where termination is subject to moisture or where conduit penetrates exterior wall, floor or roof, in refrigerated areas, classified (hazardous areas) and as indicated on the drawings.
36. Except as otherwise indicated on the Drawings or elsewhere in these specifications,



bends in feeder and branch circuit conduit 2 inches or larger shall have a radius or curvature of the inner edge, equal to not less than ten (10) times the internal diameter of the conduit. Except where sweeping vertically into a building where sweep radius equals ten (10) times conduit diameter, underground communications and building interconnect conduits 3 inches or larger shall have a minimum 12'-6" radius or curvature of the inner edge. For the serving utilities, radius bends shall be made per their respective specifications.

37. Tag all empty conduits at each accessible end with a permanent tag identifying the purpose of the conduit, footage end-to-end, and the location of the other end. In wet, corrosive outdoor or underground locations, use brass, bronze, or copper 16 gauge tags secured to conduit ends with #16 or larger galvanized wire. Inscribe on the tags, with steel punch dies, clear and complete identifying information.
38. The following additional requirements shall apply to underground conduits:
  - a. Underground conduit shall be Schedule 40 PVC (polyvinyl chloride) unless otherwise indicated elsewhere in these specifications or as required per NEC, or CEC where adopted Article 517.13.
  - b. In all cases, where any conduit(s) pass under a building slab or footing, the electrical contractor will provide a Bentonite clay or concrete barrier that conforms to the height and width of the trench excavation and is a minimum of 18" thick. In all cases, where conduit(s) pass thru a sleeve in a footing or other foundation element, the electrical contractor will provide a Bentonite clay or concrete barrier between the sleeve and the conduit(s) surrounding the conduit(s) for the entire depth of the sleeve. The barrier is required to prevent passage of moisture under or thru the slab or footing via the trench or sleeve.
  - d. Where underground conduit passes under a building slab, concrete encasement may not be required, except as required above, contact the Engineer for written direction prior to omitting any encasement.
  - e. Underground conduits, which terminate inside building(s) below grade, such as in a basement level, or which slope so that water might flow into interior building spaces, shall be sealed at the point of penetration with a modular conduit seal (Link-Seal or equal by Rox Systems). Conduit/conduit sealing system penetrations of waterproofing membranes/systems on existing structures shall be completely restored as required to maintain membrane/system manufacturer and installer warrantee for the installation. All conduits shall be provided with a 4% slope away from buildings. All conduits shall be installed such that the water cannot accumulate in the conduit and such that water drains into the nearest manhole, pull box or vault – not into the facility. In instances where grade changes or elevation differences prevent sloping of conduit away from a building into the nearest manhole, pull box or vault or where accumulation of water in a manhole, pull box or vault may result in water traveling into the facility, conduits shall be sealed internally at each end of each conduit using conduit sealing bushing, sized as required for the conductors contained within the conduit (O-Z Gedney #CSBG 100psig withstand or equal). In all cases, install plugs or caps in spare (empty) conduits at both ends of each conduit (Jackmoon or equal) able to seal both water and gas from entering the facility via the conduits.

- f. All conduits installed underground shall be entirely encased in concrete 3" thick on all sides with multiple conduits spaced not less than 1-1/2" apart, except where otherwise specified. Provide approved conduit spacers as required to prevent any deflection of conduits when concrete is placed and to preserve position and alignment of conduits in concrete. Conduits shall be tied to spacers. Anchors shall be installed to prevent floating of conduits during pouring of concrete. Red concrete shall be used to encase conduits of systems operating above 600 volts.
- g. All underground conduits shall be buried to a depth of not less than 24" below finished grade to top of the concrete envelope, unless otherwise specified.
- h. Assemble sections of conduit with approved fittings and stagger all joints. Cut ends of conduit shall be reamed to remove all rough edges. Joints in all conduits shall be made liquid-tight. All bends at risers shall be completely below surface where possible.
- i. Two or more conduit runs in a common trench shall be separated by at least 1-1/2" of concrete. Electric conduit runs installed in a common trench with other utility lines shall be separated from such lines by at least 12" horizontally. Public telephone conduits shall be separated from electric conduits or other utility lines by not less than 3" of concrete.
- j. The District's Electrical Inspector shall be called to the site for approval of all underground installations before and during concrete pour. The Contractor shall demonstrate the usability of the underground raceways installed as part of this contract. a round, tapered, rigid mandrel shall be drawn through each run of conduit in the presence of the District Inspector, and utility company inspector where applicable, before and after pouring concrete. Mandrel shall be 6" in length minimum, and have a diameter which is within 1/4" of the diameter of the conduit to be tested. Contractor shall repair or replace any conduit(s) which will not readily pass the mandrel test.
- k. Nonmetallic conduit installations shall comply with following additional requirements: All joints in PVC conduit shall be sealed by means of approved solvent-weld cement supplied by conduit manufacturer. All nonmetallic conduit bends and deflections shall comply with requirements of applicable electrical code, except that minimum radius of any bend or offset for conduits sized from 1/2" to 1-1/2" inclusive shall not be less than 24". All bends at risers and risers shall be rigid steel conduit. Radius of curve of any bend or offset, in nonmetallic conduit for public telephone system shall be not less than 10 times trade size of conduit, unless otherwise specifically approved by public telephone system.
- l. Furnish and install a 6" wide polyethylene red underground barrier type 12" above full length of concrete "CAUTION ELECTRIC LINE BURIED BELOW".
- m. All underground conduit systems for use by serving utility company shall meet all requirements of utility company.

B. Installation of 600-Volt Conductors:

1. All electrical wire, including signal circuits, shall be installed in conduit.
2. All circuits and feeder wires for all systems shall be continuous from over current protective device or switch to terminal or farthest outlet. No joints shall be made except in pull, junction or outlet boxes, or in panel or switchboard gutters.
  - a. Utilize preinsulated "winged" spring type connectors, 3M Company "Performance Plus" #O/B or #R/Y as required for splices and taps in conductors #6 AWG and smaller. When a spring connector is used in an underground environment or when subject to moisture, utilize a 3M Company Scotchcast 3507G epoxy resin connector sealing pack to seal the spring connector.
  - b. Wires #4 AWG and larger AWG shall be joined together as follows:
    - i. When located in an underground environment or when subject to moisture, the splice shall be made with compression connector and sealed by a 3M, or equal, PST cold shrink connector insulator.
    - ii. When located in an interior environment, the splice shall be made with an IlSCO or equal dual rated, insulated splice-reducer connector or multi-tap connector-listed for use with 75/90 degree Celsius rated conductors.
  - c. Connections to busbar shall be made with dual-rated copper/aluminum one-piece compression lugs. Paralleled conductor connections shall be by mechanical lugs.
3. Thoroughly clean all conduit and wire-ways and see that all parts are perfectly dry before pulling any wires.
4. Install UL approved fixture wire from all lighting fixture lamp sockets into fixture outlet or junction box.
5. For 20 ampere branch circuit wiring, increase #12 conductors to #10 for 120 volt circuits longer than 100 feet and for 277 volt circuits longer than 150 feet.
6. Conductor Support. Provide conductor supports as required by codes and recommended by cable manufacturer. Where required, provide cable supports in vertical conduits and provide lower end of conduit with a ventilator.

C. Grounding / Bonding:

1. Provide grounding and bonding for entire electric installation as shown on plans, as listed herein and as required by applicable codes. Included, but not limited to, are items that require grounding / bonding:
  - a. Conduit, Raceways and Cable Trays.
  - b. Neutral or identified conductors of interior wiring system.
  - c. Panel boards, Distribution Boards, Switchgear and Switchboards.
  - d. Non-current carrying metal parts of fixed equipment.
  - e. Telephone distribution equipment.
  - f. Inverters, UPS, PDU, RDC, Transfer Switch and Generator Systems.

- g. Raised Flooring.
  - h. Antennas.
  - i. Lightning Protection Systems.
  - j. Metal piping installed in or attached to a building/structure.
  - k. Metallically isolated structural steel.
  - l. Metallically isolated underground metal water piping.
  - m. Elevator hydraulic piston/lift case.
2. In multi-occupancy buildings, Contractor shall bond metal water piping systems installed in, under or attached to a building and/or structure serving individual occupancies where the piping system(s) are metallicity isolated from each other. Per NEC, or CEC where adopted Art. 250.104(A)(2) and (4), the bonding conductor shall be sized per Table 250.122 and connected to the switchboard/panelboard serving that suite/occupancy.
3. Use of Ground Rods: Furnish and install required number of 3/4" x 10' copper clad ground rods to meet specified resistance, all required grounding wires, conduit and clamps. The size of the grounding conductors shall be not less than that set forth in the latest edition of the California Code of Regulations, Title 24, State of California and NEC (CEC, where adopted), unless otherwise indicated. Rods shall be installed such that at least 10 feet of length is in contact with the soil. Where rock bottom is encountered, the electrode shall be driven at an oblique angle not to exceed 45 degrees from vertical or shall be buried in a trench that is at least 30 inches deep. The upper end of the electrode shall be flush with or below ground level unless the above ground end and the grounding electrode conductor attachments are protected against physical damage. Unless otherwise noted, connection to the grounding electrode conductor may be by compression type or exothermic process connector. Mechanical connectors shall not be used.
4. Grounding System Connection:
- a. Compression connectors shall be unplated copper, manufactured by Burndy, or approved equal, designed specifically for the intended connection.
  - b. Exothermic weld-type connectors shall be 'Cadweld' manufactured by Erico Products, or approved equal, designed specifically for the intended connection.
  - c. Mechanical connectors shall not be used.
5. Isolated Ground Receptacles shall have an insulated ground wire connected between the receptacle and the panelboard isolated ground bus. Unless otherwise noted, this ground wire shall not be grounded at any other point, and shall be distinguished from other ground wires by a continuous yellow stripe.
6. Provide separate green equipment ground conductor in all electrical raceways, to effectively ground all fixtures, panels, controls, motors, disconnect switches, exterior lighting standards, and noncurrent carrying metallic enclosures. Use bonding jumpers, grounding bushings, lugs, busses, etc., for this purpose. Connect the equipment ground to the building system ground. Use the same size equipment ground conductors as phase conductors, up through #10 AWG. Use NEC (or CEC where adopted) Table 250.122 for conductor size with phase conductors # 8 and larger, if not shown on the Drawings.

7. Clean the contact surfaces of all ground connections prior to making connections.
  8. Ductwork. Provide a flexible ground strap, No. 6 AWG equivalent, at each flexible duct connection at each air handler, exhaust fan, and supply fan, and install to preclude vibration.
  9. Motors. Connect the ground conductor to the conduit with an approved grounding bushing, and to the metal frame with a bolted solderless lug. Bolts, screws and washers shall be bronze or cadmium plated steel.
  10. Building grounding system resistance to ground shall not exceed 25 ohms.
- D. Line Voltage and Low Voltage Power Supplies to all Mechanical Equipment Including Plumbing, Heating and Air Conditioning Units;
1. An electric power supply, including conduit, any necessary junction and/or outlet boxes and conductors and connection shall be furnished and installed by this Contractor for each item or mechanical equipment.
  2. Power supplies to individual items of equipment shall be terminated in a suitable outlet or junction box adjacent to the respective item of equipment, or a junction box provided by the manufacturer or the equipment and directed by the Mechanical Contractor. Allow sufficient lengths of conductor at each location to permit connection to the individual equipment without breaking the wire run.
  3. The location of all conduit terminations to the equipment is approximate. The exact location of these conduit terminations shall be located and installed as directed by the Mechanical and Plumbing Contractor.
  4. Provide power supplies to all plumbing and mechanical equipment, including but not limited to, equipment furnished and installed by Owner or Contractor such as heating and air conditioning equipment, pumps, boilers, auto valves, water coolers, trap primers etc. The installation shall produce a complete and operable system.
  5. Unless otherwise noted, this Contractor shall furnish and install all conduit, boxes, wires, etc., for line voltage wiring and low voltage wiring.
  6. It is the Contractor's responsibility to verify with the Drawings of other trades regarding the extent of his responsibility for mechanical equipment. The bid must include a sum sufficient to cover the cost of the installation.
  7. The location of all power supply connection and/or terminations to the mechanical equipment is approximate. The exact locations of these terminations shall be verified with other trades during construction.
- E. Prefabricated Equipment: Installation of all prefabricated items and equipment shall conform to the requirements of the manufacturer's specifications and installation instruction pamphlets. Where code requirements affect installation of materials and equipment, the more stringent requirements, code or manufacturer's instructions and/or specifications, shall govern the work.
- F. Firestopping:

1. The Contractor shall be responsible for furnishing all material, labor, equipment, and services, in conjunction with the selection and installation of a complete and fully functioning and code compliant UL-listed fire stop assembly/system(s) as required by project conditions.
2. Each fire stop assembly/system shall have an "F" and/or "T" rating as required by each condition requiring fire stopping. Each fire stop assembly/system shall have a current U.L. listing, as indicated in the latest edition of the U.L. Fire Resistance Directory. Contractor shall verify acceptability of all fire stopping methods and system selections with the authority having jurisdiction prior to installation. The Contractor shall install each firestop assembly/system in accordance with the manufacturer's printed instructions.
3. Each fire stop assembly/system shall be labeled with fire stop manufacturer-furnished label on each side of the fire stopping systems depicting UL # etc.

G. Housekeeping Pads

1. Provide a minimum 3" high housekeeping pad above finished floor/finished grade for all exterior floor mounted switchgear, switchboards, distribution boards, transformers, motor control centers etc flush with the face of the equipment. Provide a minimum 3" high housekeeping pad for all floor mounted switchgear, distribution boards, transformers, motor control centers, transfer switches etc located in mechanical central plant(s) and other mechanical spaces flush with the face of the equipment. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions regarding housekeeping pads are met.
1. Unless otherwise noted above, provide a minimum 1-1/2" high housekeeping pad above finished floor/finished grade for all interior floor mounted switchgear, switchboards, distribution boards, transformers, motor control centers, transfer switches etc flush with the face of the equipment. All housekeeping pad heights are as measured from finished floor or grade. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions regarding housekeeping pads are met.
2. Provide a 1-1/2" high housekeeping pad above finished floor/finished for service equipment. Prior to pad rough-in, Contractor shall verify serving utility company's maximum meter height requirements and, if necessary, adjust height of housekeeping pad to comply with those requirements. In indoor applications, the pad shall be flush the face of the switchgear. In outdoor applications, the housekeeping pad shall extend a minimum of 4 feet from the front of switchgear/switchboard's weatherproof enclosure. Confirm pad dimensions with local inspector prior to forming pad to ensure any local code interpretations/conditions regarding housekeeping pads are met.
3. All housekeeping pads located in, on or attached to a building shall be seismically braced/connected to the building structure.

H. Feeder Identification

1. Lighting, power, low voltage feeder wires and cables shall be identified at each point conduit run is broken by a cabinet, box, gutter, etc. Where terminal ends are available, identification shall be by means of a heat shrink wire marker, which provides terminal

strain relief, Raychem Shrinkmark, or Brady Permasleeve markers. Identification in other areas shall be by means of wraparound tape markers Raychem Cable Markers, or Brady Perma-Code. All markers shall include the feeder designation, size and description.

I. Tape

1. Splices, joints and connectors joining conductors shall be covered with insulation equivalent to that on conductors. Free ends of conductors connected to an energized source shall be taped. Voids in irregular connectors shall be filled with insulating compound before taping. Thermoplastic insulating tape approved by UL for use as sole insulation of splices shall be used and shall be applied according to manufacturer's printed specifications.

J. Testing

1. The Contractor shall obtain an independent NETA certified testing service that will provide all instrumentation and tests on the entire campus electrical system and all new and/or existing electrical equipment as hereinafter described and further directed by the Architect. The test shall be performed after the completion of all electrical systems. All tests shall be recorded, documented and submitted to the Architect for review. Submit three (3) copies on an official form indicating project location, test engineer, test conditions, test equipment data, ground system layout or diagram and final test results.
  - a. Test for Phase to Ground/Defective Insulation Condition:
    - Open main service disconnect.
    - Isolate the system neutral from ground by removing the neutral disconnect link located in the service switchboard.
    - Close all submain disconnects.
    - Close all branch feeder circuit breakers.
    - Measure the resistance of each phase to ground. A properly calibrated "Megger" type test instrument to be used. The test voltage shall be 500 volts.
    - Record all readings after one-minute duration and document into a complete report.
  - b. Isolating Grounds: In the event that low resistance grounds are found in the system, they shall be isolated and located by testing each circuit individually as outlined above. Make proper corrections to restore the resistance values to an acceptable value.
2. Method of obtaining ground resistance shall be in accordance with the latest edition of the James G. Biddle (Plymouth Meeting, Pennsylvania) manual published on this subject.
  - a. Perform "fall-of-potential" tests on the main grounding electrode of system per IEEE Standard No. 81, Section 8.2.1.5 when suitable locations for test rods are not available, a low resistance dead earth or reference ground will be utilized.
  - b. Perform the two-point method test per IEEE Standard No. 81, Section 8.2.1.1, to determine the ground resistance between the main grounding system and all major electrical equipment frames, system neutral, and/or derived neutral points, ground rod and building steel, utility piping such as water and gas and panelboard grounds. Metal railings at building entrances and handicap ramps shall also be tested.

- c. Acceptable testing equipment: Vibroground by Associated Research, Inc.; Megger Earth Tester by James G. Biddle Company; or equivalent by Megger.
3. Provide arc flash analysis for all new and existing switchgear on campus, whether or not shown in the Contract Documents and include arc flash hazard labels.
  4. Provide a complete circuit breaker coordination study from the main circuit breaker at the main switchboard down to branch circuit breakers at the panelboards. The system shall be fully coordinated such that a fault anywhere in the system will only affect the next circuit protective device ahead of the fault.
  5. All instrumentation and personnel required for testing shall be provided by the Contractor at the Contractor's expense.
  6. All ground fault equipment shall be tested by a certified testing laboratory and shall be set as recommended by the switchgear manufacturer so as to be coordinated with other protection devices within the electrical design. Copies of the coordination test and settings shall be sent to the Architect.
  7. Take and record ampere and line voltage measurements under full load on all panels and switchboard feeders and motor circuits over 10 horsepower and/or 14 amperes. Record measurements at the equipment served and submit to the Architect for review.
  8. If, in the opinion of the Architect, the voltages and regulations are not met within acceptable limits, make arrangements with the serving utility for proper electrical service and then verify that such has been provided.
  9. Refer to testing (additional requirements) elsewhere in this specification for additional testing requirements.
  10. The maximum resistance to ground shall not exceed 5 ohms.
  11. Upon completion of work, the Contractor shall make additional tests as necessary to satisfy the Owner or the Architect or his representative that the true intent and meaning of the drawings and specifications have been carried out. Contractor shall provide all instruments and labor necessary to make such tests. Any work showing faults under test, and any work not in accordance with the specifications, shall be made good by the Contractor at his own expense. Such tests may occur at anytime during the guarantee period.

END OF SECTION 26 01 00



**SECTION 26 01 70**  
**GROUNDING AND BONDING**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Grounding electrodes and conductors.
- B. Equipment grounding conductors.
- C. Bonding.

**1.2 REFERENCES**

- A. ANSI/NFPA 70 - National Electrical Code.
- B. C.E.C. - California Electrical Code.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Grounding System Resistance: 20 ohms maximum.

**1.4 PROJECT RECORD DOCUMENTS**

- A. Submit under provisions of Division 01.
- B. Accurately record actual locations of grounding points.

**PART 2 - PRODUCTS**

**2.1 ROD ELECTRODE**

- A. Material: Copper-clad steel.
- B. Diameter: 3/4 inch.
- C. Length: 10 feet.

**2.2 MECHANICAL CONNECTORS**

- A. Material: Bronze.

**2.3 WIRE**

- A. Material: Stranded copper.
- B. Foundation Electrodes: 4/0 AWG.
- C. Grounding Electrode Conductor: Size to meet CEC requirements, minimum.

- D. Equipment Grounding Conductor: Size conductors based on CEC Table 250-122.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that final backfill and compaction has been completed before driving electrodes.

#### 3.2 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Install rod electrodes at locations indicated.
- C. Provide grounding electrode conductor and connect to reinforcing steel in foundation footing where indicated. Bond steel together.
- D. Provide bonding to meet Regulatory Requirements.
- E. Provide isolated grounding conductor for circuits supplying isolated ground receptacles.
- F. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- G. Raceway Systems: Install metallic raceways mechanically and electrically secure at all joints and at all boxes, cabinets, fittings and equipment. At the point of electrical service entrance, bond all metallic raceways together with a ground conductor and connect to the system ground bus. Bond all boxes for equipment.
- H. Receptacles: Permanently connect the ground terminal on each receptacle to the green ground conductor.
- I. Motors: Connect the ground conductor to the conduit with an approved grounding bushing and to the metal frame with a bolted solderless lug. Bolts, screws, and washers shall be bronze or cadmium plated steel. Remove paint where grounding bushing attaches to the disconnect switch.
- J. Telecom Room: Provide one No. 6 THW copper wire in 21 mm (3/4") conduit from the main telephone cabinet to the grounding system or as indicated on drawings.
- K. Ductwork: Provide a flexible ground strap, No. 6 AWG equivalent, at each flexible duct connection at each air handler, exhaust fan, and supply fan, and install to preclude vibration.
- L. Bond together metal siding and other metal objects not attached to grounded structure; bond to ground.
- M. Bond together each metallic raceway, pipe and duct at least at one point; bond to ground.

#### 3.3 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of potential method.

END OF SECTION 26 01 70

**SECTION 26 01 90**  
**SUPPORTING DEVICES**

**PART 1 - GENERAL**

**1.1 WORK INCLUDED**

- A. Conduit and equipment supports.
- B. Fastening hardware.

**1.2 COORDINATION**

- A. Coordinate size, shape and location of concrete pads with Section Cast-in-Place Concrete.

**1.3 QUALITY ASSURANCE**

- A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

**PART 2 - PRODUCTS**

**2.01 MATERIAL**

- A. Support Channel: Galvanized or painted steel.
- B. Hardware: Corrosion resistant.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Use expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.
- B. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
- C. Do not use powder-actuated anchors.
- D. Do not drill structural steel members without Structural Engineer approval.
- E. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- F. Provide conduit support systems under provisions of Section 26 01 11.

END OF SECTION 26 01 90

**SECTION 26 01 95**

**ELECTRICAL IDENTIFICATION**

**PART 1 - GENERAL**

**1.1 WORK INCLUDED**

- A. Nameplates.
- B. Wire and cable markers.

**1.2 SUBMITTALS**

- A. Submit shop drawings under provisions of Division 01.
- B. Include schedule for nameplates and tape labels.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Nameplates: Engraved three-layer laminated plastic, white letters on a black background.
- B. Wire and Cable Markers: Cloth markers, split sleeve or tubing type.
- C. Conduit label markers: Color coded, weather resistant adhesive backed.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Degrease and clean surfaces to receive nameplates.
- B. Install nameplates and tape labels parallel to equipment lines.
- C. Secure nameplates to equipment fronts using screws, or rivets. Secure nameplate to inside face of recessed panelboard doors in finished locations.
- D. Embossed tape will not be permitted for any application.

**3.2 WIRE IDENTIFICATION**

- A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with panel and branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams equipment manufacturer's shop drawings for control wiring.

### 3.3 NAMEPLATE ENGRAVING

- A. Provide nameplates to identify all circuits in the service distribution and power distribution panelboards; branch circuit panelboards; separately mounted starting switches; disconnecting switches; motor control push-button stations; selector switches; terminal cabinets; telephone cabinets, etc. Clearly identify on the nameplate the equipment such as "Air Handling Unit AH-1" and "Hot Water Cir. Pump P-1" in lieu of abbreviated plan references such as "AH-1" or "P-1". In addition all voice and data racks, patch panels and workstation outlets will be labeled.
- B. Provide nameplates of minimum letter height as scheduled below.
- C. Panelboards and Switchboards: 1/4 inch; identify equipment designation, voltage rating, and source.
- D. Individual Circuit Breakers In Panelboards and Switchboards: 1/8 inch; identify circuit and load served, including location.
- E. Individual Circuit Breakers, Enclosed Switches and Motor Starters: 1/8 inch; identify voltage rating, ampere rating and load served including location.
- F. HVAC and Plumbing Control Equipment: 1/8 inch; identify equipment designation and equipment served including location.
- G. Communication Terminal Cabinets: 1/4 inch; identify cabinet designation and type of system.
- H. Patch Panels: Will be uniquely numbered in each BDF as follows: Patch Panels A through Z; Patch panel jack numbers 1 thru 48.
- I. Voice/Data workstation outlets: All workstation outlets will clearly labeled to indicate BDF room number, patch panel letter and jack number. Example "15A44" ; Indicating BDF room #15, Patch panel A, jack # 44.

### 3.4 RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Color for Printed Legend:
  - Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
  - Color: Black letters on orange field.
  - Color tracer on neutral conductors for identification. Legend: Indicate system or service and voltage, if applicable.
  - Control Circuits: Control wire numbers indicated on schematic or interconnection diagrams on shop drawings.

1. Self-Adhesive Vinyl Labels: Pre-printed, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
2. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, 2 inches wide, fade resistant, compounded for outdoor use.
3. Raceway/Conduits Identification Labels:
  - a. All signal systems and lighting systems shall be identified with weather-resistant, fade-resistant labels identifying the system. Each system shall be color-coded as described below.
  - b. Labels shall be placed by Electrical and/or Low Voltage Contractor on every conduit run, within 2 feet of every junction box or connector, and each 10 feet thereafter (1 label per every 10 feet of conduit). Labels shall wrap around conduit and placed for maximum visibility.
  - c. All junction boxes, not otherwise identified, shall have a system identification label on the cover.
  - d. A laminated schedule shall be posted in each electrical, mechanical, and signal room, showing each label and the system it identifies.
  - e. Label Colors:

System Type	Identification	Background	Lettering
Lighting and Power	Standard Voltage	Orange	White
Cable Television	CATV	Brown	White
Clock	CLOCK	Black	White
Data	DATA	Violet	White
Emergency Circuits	EMERG	Yellow	Black
Energy Management System	EMS	White	Black
Fiber Optic System	FIBER	Pink	Black
Fire Alarm	FIRE	Red	White
Independent Public Address	IPA	Gray	White
Security/Intrusion	SECUR	Green	White
Telecommunications	TELECOM	Blue	White

END OF SECTION 26 01 95



**SECTION 26 05 19**  
**LOW VOLTAGE POWER CONDUCTORS AND CABLES**

**PART 1 – GENERAL**

**1.1 SECTIONS INCLUDES**

- A. Basic conductor / cable types and limitations of usage. Requirements on termination to panels and vertical runs.
- B. Furnish and install proper lugs in all panelboards, switchboards, gutters, etc., required to properly terminate every cable. Where paralleled conductors or conductors of large size are to terminate on a breaker a short length of copper cable (of capacity of the breaker) shall be connected to the breaker, and the proper bolt or compression type lug installed to connect this cable to the feeder cable. The cutting of cable strands to fit the breaker will not be permitted. Lugs shall be Burndy, ILSCO or approved equal.
- C. Vertical cable supports shall be provided in all light and power system runs at all pull boxes or at panelboards in vertical feeders and in all other light and power system runs other than feeders at spacing's not exceeding code requirements. Cable supports shall be with split type impregnated hardwood plugs for synthetic insulated cables, O.Z./Gedney Company Type "S" for voltages to 600 and Type "R" for voltages above 2,000.

**PART 2 – PRODUCTS**

**2.1 COPPER, 600 VOLTS**

- A. All conductors shall be delivered to the site in their original unbroken packages, plainly marked or tagged as follows:
  - 1. Underwriters' labels.
  - 2. Size, kind and insulation of wire.
  - 3. Name of the manufacturing company and the trade name of the wire.
  - 4. Month and year when manufactured which date shall not exceed 2 years prior to the date of delivery to the site.
- B. All conductors shall be minimum of 98% conductivity, soft drawn copper. Provide stranded conductor for #8 AWG and larger or when making flexible connections to vibrating machinery. Use compression "fork" type connectors or transition to solid conductors when connecting to switches, receptacles, etc.
- C. Wire shall be single conductor type THHN or THWN insulated with polyvinyl chloride (PVC) and covered with a tough protective sheath of nylon, rated at 600 volts. The wire may be operated at 90° C. maximum continuous conductor temperature in dry locations and 75° C. in wet locations and shall be listed by Underwriters Laboratories under Standard 83 for Thermoplastic Insulated Wires. Conductors shall be solid copper for #10 AWG and smaller conductors and stranded copper for #8 AWG and larger conductors. Each conductor shall be insulated with PVC and sheathed with nylon. Each wire shall be identified by surface marking indicating manufacturer's identification, conductor size and metal, voltage rating, UL symbol, type designations and optional rating. Wire shall be tested in accordance with the requirements of UL Standard for types THWN or THHN.
- C. Conductors shall be solid Class B or stranded Class C, annealed uncoated copper per UL Standards 83 or 1063.

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES  
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- D. Wire and cable shall be new, manufactured not more than six (6) months prior to installation, shall have size, type of insulation, voltage rating and manufacturer's name permanently marked on outer covering at regular intervals.
- E. Wire and cable shall be factory color-coded by integral pigmentation with a separate color for each phase and neutral. Each system shall be color-coded and it shall be maintained throughout.
- F. Systems Conductor Color Coding:
1. Power 208/120V, 3PH, 4W:
    - (a) Phase A = Black
    - (b) Phase B = Red
    - (c) Phase C = Blue
    - (d) Neutral = White
    - (e) Switchlegs = Purple (Switchlegs shall also be identified separately by numerical tags).
    - (f) Travelers = Purple with Black stripe.
  2. Power 480/277V, 3PH, 4W:
    - (a) Phase A = Brown
    - (b) Phase B = Orange
    - (c) Phase C = Yellow
    - (d) Neutral = Grey
    - (e) Switch legs = Purple (Switchlegs shall also be identified separately by numerical tags).
    - (f) Travelers = Purple with black stripe.
  3. Color Code for Clocks, Program Bells, Program Selector and Fire Alarm System Devices.
  4. Color Code, Signal Systems: Wires for signal systems shall be color coded and shall be installed under direction of the District's Electrical Inspector. Except where otherwise specified, color coding shall be as follows:

<u>SYSTEM</u>	<u>COLOR CODE</u>
Clocks	Pink, Gray and Orange
Program Bells (Elementary Schools)	White (Common) Black
Program Bells (Secondary Schools)	White (120 volt common) Black (C.R. Program) Blue (Shop Program) Brown (Gym Program) Yellow (Aud. Fire Alarm)
Fire Alarm Bells or Horns	Black (-) and Red (+)
Fire Alarm Strobe	Brown and Yellow
Fire Alarm System Feeder or Service	Black and White

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Fire Alarm Pull Stations (Non-Addressable)	Orange and Blue
Smoke Detectors, Heat Detectors (Non-Addressable)	Red (+) and Yellow (-)
Duct Smoke Detectors (Non-Addressable)	Red (+) and Yellow (-)
Fire Sprinkler Flow Switch (Non-Addressable)	Red (+) and Purple (-)
Fire Sprinkler Tamper Switch (Non-Addressable)	Red (+) and Brown (-)
White Visual Program Signal	Yellow with White Stripes, White (common)
Program Switching Unit	Blue (Hot) White (common) 4 - Black (C.R. Program) 4 - Yellow (Shop Program) 4 - Blue (Gym Program) Blue ("All" Button) 2 - Black (Spares)
Spare Wires	Black

5. Ground Conductors: Green
  6. Isolated Ground Conductors: Green with continuous yellow stripe.
  7. Fire Alarm System: As recommended by the manufacturer.
- G. All color-coding for #12 thru #6 AWG conductor shall be as identified above. Conductors #4 AWG and larger shall be identified with utilizing phase tape at each termination.
- H. No conductors carrying 120 volt or more shall be smaller than #12 AWG.
- I. Aluminum conductors shall not be used.
- J. Wire-pulling compounds used as lubricants in installing conductors in raceways shall only be "Polywater J". No oil, grease, graphite, or similar substances may be used. Pulling of #1/0 or larger conductors shall be done with an approved cable pull machine. Other methods; e.g. using vehicles and block and tackle to install conductors are not acceptable.
- K. Connectors and terminal lugs shall be used for terminating stranded conductors #8 and larger shall be T&B, ILSCO, or equal, solderless connectors.

PART 3 – EXECUTION

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES  
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3.1 COPPER, 600 VOLTS

- A. Connectors and terminal lugs shall be used for terminating stranded conductors #8 and larger.
- B. All branch circuit and fixture wiring joints, splices and taps for conductors #10 and smaller shall be made with UL approved connectors listed for 600 volts. Connector bodies shall consist of a cone shape expandable coil spring insert, insulated with Teflon or plastic shell.
- C. Make all connections and splices necessary to properly install and complete the work, and all splices shall be taped. All tape shall be 3M "Scotch" #33 plastic electrical tape. All connections and splices shall be electrically and mechanically perfect, and in strict accordance with all code requirements.
- D. Bolt type solderless connectors shall be tightened and then retightened after 24 to 48 hours before taping. DSA Inspector shall be informed of this procedure during the waiting period and shall witness the act of retightening.
- E. All debris and moisture shall be removed from the conduits, boxes and cabinets.
- F. No oil, grease, or similar substances shall be used to facilitate the pulling in of conductors. Use mineralac, linseed soap or specifically approved wire pulling compound.
- G. Wire in panel cabinets, pull boxes and wiring gutters shall be neatly grouped, taped together with 3M "Scotch" #33 plastic electrical tape, T&B Model Ty-Rap cable strap or laced with #12 standard lacing twine and fanned out to the terminals.
- H. No splices shall be allowed in any cast iron or concrete pull box, unless it is specifically called for on the drawings or it is with the specific written approval of the Architect. When splices are allowed a Thomas & Betts No. HS-LR series watertight heat shrink process jacket over the splice shall be used.
- I. See paragraphs under "Panelboards" as hereinafter specified for branch circuit wiring color code.

END OF SECTION 26 05 19

**SECTION 26 05 33**  
**RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Basic definitions of conduit types and raceway applicable to this project
- B. All raceways shall comply with the requirements of the Underwriter's Laboratories and shall be delivered to the site in standard lengths with each length bearing the manufacturer's trademark or stamp and the Underwriters' label of approval.
- C. Where conduit is mentioned in this Specification, this shall be interpreted as rigid, standard weight steel conduit. Intermediate metal conduit (IMC), electrical metallic tubing, aluminum, polyvinyl-chloride or flexible metallic conduit shall be used only where specified herein or noted on the drawings.
- D. Raceways other than conduit (in the general sense) such as wireways, cable tray, etc., shall only be used when, where and as allowed by the drawings and this Specification and in compliance with the CEC.

**PART 2 – PRODUCTS****2.1 CONDUIT**

- A. Galvanized Rigid Conduit (GRC) shall be full weight threaded type steel. Steel conduit shall be protected by overall zinc coating to inside and outside surfaces, applied by the hot dip, metallizing, or sherardizing process. All couplings, etc., shall be of the threaded type only.
- B. Intermediate Metal Conduit (IMC), shall be hot-dipped galvanized in accordance with UL 1242 and meeting Federal Specification WWC-581 (latest revision). Couplings, locknuts and bushings for IMC shall be threaded, comparable to those specified for standard weight rigid steel conduit.
- C. Electrical metallic tubing shall be galvanized or sherardized. Couplings and connectors shall be galvanized or cadmium plated, steel or die cast, insulated throat and shall be of the compression type. Approved devices are:

<u>Manufacturer</u>	<u>Connector</u>	<u>Coupling</u>
Appleton	TW-CSI Series	TWC-CS Series
Appleton	86T Series	95T Series
Bridgeport	250-DCI Series	260-DC Series
Regal	601S-606S Series	611-616 Series

- D. Flexible metallic conduit shall be standard or intermediate weight hot dipped galvanized steel and shall have all fittings hot dipped galvanized or sherardized. Fittings shall be the squeeze type. Fittings which use a screw to bind against tubing will not be accepted. Screw-in "Jake" connectors will be accepted only if the conduit is cut "square". Aluminum flexible conduit is not acceptable under this specification.

- D. Neoprene jacketed flexible metallic conduit shall be UL listed, Type UA, liquid tight (sealtite). See this Section under "Execution" for mandatory application of liquid tight flexible conduit. Fittings shall be equal to Appleton "STN" series.
- F. Factory assembled, or off-site assembled wiring systems (such as Metal Clad (MC) Cable, Type AC Cable, Type NM Cable, Type BX Cable, etc...) shall not be used unless otherwise indicated in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing.
- G. When approved for use in the Allowed Specification Deviations Section, generally located on the symbols list drawing, MC cables shall be allowed for lighting branch circuits (homeruns shall be EMT), receptacle branch circuits (homeruns shall be EMT) and poke-thru fed systems furniture homeruns. MC shall not be used where exposed, except for a maximum 6' length for final connections to light fixtures, or terminate in electrical panelboards or distribution boards. Equipment ground conductor shall be green. Isolated ground conductor shall be green with yellow stripe. Provide 600V rated aluminum or lightweight steel interlocking armor Metal Clad (MC) cable with copper conductors, THHN (90 degree C) insulation, and integral equipment grounding conductor and isolated grounding conductor as required. Type AC cable listed for use in patient care areas per NEC or CEC where adopted, Article 517.13 shall be required in such areas in lieu of MC cable. MC cable shall be manufactured to UL Standard 1569. See Execution section of this specification for additional installation requirements.
- H. Nonmetallic Flexible Tubing (ENT) shall not be used unless otherwise indicated in the Allowed Specification Deviations Section or Deductive/Additive Alternate Pricing Section generally located on the symbols list drawing. Use of ENT, if allowed, is strictly limited to use in CMU walls and parking structures decks or as directed in writing by the Engineer. See Execution section of this specification for additional installation requirements.
- I. Non-Metallic Conduit:
1. Polyvinyl chloride (PVC) rigid conduit, Schedule 40, Type II for underground installation only with solvent welded joints, conforming to Underwriters Laboratories, Inc. (U.L.) requirements, listed for exposed and direct burial application.
  2. Conduit and fittings shall be produced by the same manufacturer.
- J. Bushings for standard weight rigid steel conduit shall be nonmetallic for 1" and smaller. For conduits 1-1/4" and larger, insulated metallic bushings shall be used. Bushings shall be O. Z. Electrical Mfg. Co., Type "B" regular type or Type "BL" grounding type.
- M. Electrical metallic tubing shall be galvanized or sherardized. Couplings and connectors shall be galvanized or cadmium plated, steel or die cast, insulated throat and shall be of the compression type. Approved devices are:

<u>Manufacturer</u>	<u>Connector</u>	<u>Coupling</u>
Appleton	TW-CSI Series	TWC-CS Series
Appleton	86T Series	95T Series
Bridgeport	250-DCI Series	260-DC Series
Regal	601S-606S Series	611-616 Series

- N. Polyvinyl-chloride (PVC) conduit shall be rigid heavyweight type, Schedule 40, Underwriters'

approved, complete with PVC fittings.

- O. Rigid aluminum conduit shall not be used.

## 2.2 FITTINGS

- A. Condulet type fittings shall be smooth inside and out, taper threaded with integral insulating bushing and of the shapes, sizes and types required to facilitate installation or removal of wires and cables from the conduit and tubing system. These fitting shall be of metal, smooth inside and out, thoroughly galvanized, and sherardized cadmium plated.
- B. Metallic condulet covers shall have the same finish as the fitting and shall be provided for the opening of each fitting where conductors do not pass through the cover.
- C. Connector, coupling, locknut, bushings and caps used with rigid conduit shall be steel, threaded and thoroughly galvanized. Bushings shall be insulated.
- D. U.O.N. all EMT fittings, connectors and couplings installed in concealed locations, areas not considered to be wet or damp locations by the AHJ, or areas not subject to physical damage, shall be steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. Where suitable for use, steel set screw fittings are allowed for trades sizes of 2" and smaller. Insulated throat is not required for fittings, connectors and couplings 1" and smaller.
- E. All interior and exterior EMT fittings, connectors and couplings, 2" and smaller, installed in exposed or concealed locations that are considered by the AHJ to be wet or damp locations, shall be raintite-listed, steel zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. If raintite-listed, steel, zinc or cadmium plated, threadless, compression, steel locking ring type with insulated throat. If raintite-listed, EMT fittings, connectors and couplings are unavailable for a given trade size or if conduit is installed in an area subject to damage – provide rigid metallic or intermediate metallic conduits, fittings, connectors and couplings as required.
- F. Flexible steel conduit connectors shall be a malleable iron clamp or squeeze type or steel twist-in type with insulated throat. The finish shall be zinc or cadmium plating.
- G. Conduit unions shall be "Erickson" couplings, or approved equal. The use of running threads will not be permitted.

## PART 3 – EXECUTION

### 3.1 CONDUIT INSTALLATION

- A. Rigid Steel and Intermediate Metal Conduit (IMC):
  - 1. Rigid steel conduit shall be used where subject to mechanical injury, where installed in concrete, where used exposed on exterior work and where installed exposed on interior work below 8 feet or where suspended. IMC may be used in lieu of standard weight rigid steel conduit in all cases except for above ground conduits containing conductors operating at over 600 volts.
  - 2. Only rigid steel conduit shall be used above grade for 601 volt and higher circuits.
- B. Electrical Metallic Tubing (Steel Tube):

1. Electrical metallic tubing may be used for all interior above ground applications except where noted to be rigid steel or flexible conduit in these Specifications or as noted otherwise on the drawings. All EMT shall have UL label.
2. EMT may be used where installed in floor slab of multi-story construction other than in slab on grade.

C. Flexible Steel Conduit:

1. Flexible steel conduit shall be used only where noted on the drawings, where required for connection to motors, etc., or with the approval of the Architect, where absolutely necessary due to structural conditions.
2. Plastic coated flexible metallic conduit (Sealtite), complete with proper fittings, shall be used in lieu of regular flexible conduit in all areas subject to moisture, dampness, rain; in excessively dusty or dirty areas; where subjected to constant personnel contact; for connections to all kitchen equipment; for connections to all shop equipment and where specifically called for on the drawings.
3. Flexible aluminum conduit shall not be used.

D. PVC Conduit:

1. PVC conduit shall not be used above grade except where it is specifically indicated otherwise herein, or noted on the drawings. All riser ells (as well as all conduit extensions) from PVC systems exposed or extended into masonry walls shall be rigid steel. All other riser ells extending into concealed areas above grade from underground PVC may be EMT or rigid steel at the Contractor's option. The underground portion of all steel ells shall be encased in concrete.
2. Connections, bending, cutting and installation shall be as recommended by the manufacturer.

E. Rigid Aluminum Conduit shall not be used.

F. All conduit of every type, used for electrical systems of 110 volts to ground or higher, shall have a copper ground wire installed therein. See Section under Grounding for sizing of ground wire. Conduit fill shall include the ground wire in all cases. See Section 16450.

G. Conduit shall be concealed, unless otherwise indicated. All conduit runs exposed to view, except those in attic spaces, shall be installed parallel, or at right angles to structural members, walls, or lines of the building.

H. Conduit shall be kept at least 6" from the covering on hot water and steam pipes, and 18" from the covering on flues and breaching. The open ends of all conduit shall be kept closed with approved conduit seals during the construction of the building. Use approved conduit unions where union joints are necessary. Running threads will not be permitted.

I. Conduit bends, other than factory ells, shall have radius of not less than 10 times the internal diameter of the conduit.

END OF SECTION 26 05 33



**SECTION 26 09 23**  
**NETWORK LIGHTING CONTROLS**

**PART 1 – GENERAL**

**1.1 SUMMARY**

- A. The lighting control system specified in this section shall provide sensor-based (both occupancy and daylight), and manual lighting control.
- B. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed)
- C. All system devices shall be networked together enabling digital communication and shall be individually addressable.
- D. The system architecture shall be capable of enabling stand-alone groups (rooms) of devices to function in some default capacity even if network connectivity to the greater system is lost.
- E. The system shall not require any centrally hardwired switching equipment.

**1.2 SUBMITTALS**

- A. Product Datasheets (general device descriptions, part numbers, dimensions, wiring details, nomenclature).
- B. Riser Diagrams – typical per room type (provide detailed drawings showing device interconnectivity of total quantity of devices).
- C. Other Diagrams – as needed for special operation or interaction with other system(s).
- D. Example Contractor Startup/Commissioning Worksheet – must be completed prior to factory start-up.
- E. Hardware and Software Operation Manuals.
- F. Other operational descriptions as needed

**1.3 QUALITY ASSURANCE**

- A. All steps in sensor manufacturing process shall occur in the USA; including population of all electronic components on circuit boards, soldering, programming, wiring, and housing.
- B. All components and the manufacturing facility where product was manufactured must be ROHS compliant.
- C. The sensors shall be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.

- D. All applicable products must be UL / CUL Listed or other acceptable national testing organization.

#### 1.4 COORDINATION

- A. Coordinate lighting control components to form an integrated interconnection of compatible components.
- B. Coordinate lighting controls with BAS where noted on bid documents either through IP based intercommunication of system or hardwired auxiliary relay outputs.
- C. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

#### 1.5 WARRANTY

- A. All devices in lighting control system shall have a 5 year warranty.

#### 1.6 COMMISSIONING

- A. Provide factory-certified field service engineer to ensure proper system installation and operation under following parameters:
  - 1. Qualifications for factory-certified field service engineer:
    - a. Minimum experience of 2 years training in the electrical/electronic field.
    - b. Certified by the equipment manufacturer on the system installed.
  - 2. Site visit activities:
    - a. Verify connection of power feeds and load circuits.
    - b. Verify connection of controls.
    - c. Verify system operation control by control, circuit by circuit.
    - d. Obtain sign-off on system functions.
    - e. Demonstrate and educate Owner's representative on system capabilities, operation and maintenance

#### 1.7 MAINTENANCE

- A. Make ordering of new equipment for expansions, replacements, and spare parts available to end user.
- B. Make new replacement parts available for minimum of ten years from date of manufacture.
- C. Provide factory direct technical support hotline 24 hours per day, 7 days per week.
- D. Provide on-site service support within 24 hours anywhere in continental United States and within 72 hours worldwide except where special visas are required.
- E. Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system commissioning.

### PART 2 – PRODUCTS

## 2.1 MANUFACTURERS

- A. This specification is based on the nLight® Network Control System from Sensor Switch, an Acuity Brands Company (800-727-7483, [www.sensorswitch.com](http://www.sensorswitch.com)).

## 2.2 SYSTEM REQUIREMENTS

- A. System shall have an architecture that is based upon three main concepts; 1) intelligent lighting control devices 2) standalone lighting control zones 3) network backbone for remote or time based operation.
- B. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.
- C. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.
- D. Devices within a lighting control zone shall be connected with CAT-5e low voltage cabling in any order.
- E. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.
- F. Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.
- G. Power for devices within a lighting control zone shall come from either resident devices already present for switching (relay device) or dimming purposes, or from the network backbone. Standalone "bus power supplies" shall not be required in all cases.
- H. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in a remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.
- I. Individual lighting zones shall be capable of being segmented into several "local" channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.
- J. System shall be capable of operating a lighting control zone according to several sequences of operation. System shall be able to change a spaces sequence of operation according to a time schedule so as to enable customized time-of-day, day-of-week utilization of a space. Note operating modes should be utilized only in manners consistent with local energy codes.
1. Auto-On / Auto-Off (via occupancy sensors)
- Zones with occupancy sensors automatically turn lights on when occupant is detected.

- Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
  - Pressing a switch will turn lights off. The lights will remain off regardless of occupancy until switch is pressed again, restoring the sensor to Automatic On functionality.
2. Manual-On / Auto-Off (also called Semi-Automatic)
- Pushing a switch will turn lights on.
  - Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
3. Manual-On to Auto-On/Auto-Off
- Pushing a switch will turn lights on.
  - After initial lights on, zones with occupancy and/or photocell sensors turn lights on/off according to occupancy/vacancy and/or daylight conditions.
  - Sequence can be reset via scheduled (ex. daily each morning) events
4. Auto-to-Override On
- Zones with occupancy sensors automatically turn lights on when occupant is detected.
  - Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
  - Sequence can be reset via scheduled (ex. daily each morning) events
5. Manual-to-Override On
- Pushing a switch will turn lights on.
  - Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.
  - Sequence can be reset via scheduled (ex. daily each morning) events
6. Auto On / Predictive Off
- Zones with occupancy sensors automatically turn lights on when occupant is detected.
  - Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.
  - If switch is pressed, lights turn off and a short "exit timer" begins. After timer expires, sensor scans the room to detect whether occupant is still present. If no occupancy is detected, zone returns to auto-on. If occupancy is detected, lights must be turned on via the switch.

- K. System shall provide the option of having pre-terminated plenum rated CAT-5 cabling supplied with hardware.

## 2.3 INDIVIDUAL DEVICE SPECIFICATIONS

### A. Networked System Occupancy Sensors

1. Occupancy sensors system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
2. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
3. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional "dual" technology shall be used.
4. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens

for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.

5. All sensing technologies shall be acoustically passive meaning they do not transmit sound waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.
  - a. Sensors shall be available in multiple lens options which are customized for specific applications.
  - b. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
  - c. All sensors shall have two RJ-45 ports or capable of utilizing a splitter.
  - d. All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5 connections) and blink its LED in a pattern to visually indicate of a potential wiring issue
  - e. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.
  - f. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.
  - g. Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements.
  - h. Network system shall also have ceiling, fixture, recessed, & corner mounted sensors available.
  - i. Fixture mount sensors shall be capable of powering themselves via a line power feed.
  - j. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.
  - k. Sensors shall be the following Sensor Switch model numbers, with device options as specified:

Model # Series	Occupancy Poles	# of Relays	Lens Type	Detection Technology
nCM PDT 9	1	-	Standard	Dual
nCM PDT 10	1	-	Extended	Dual
nWV PDT 16	1	-	Wide View	Dual

Note: Recessed

Note: Recessed mount versions of the above ceiling(fixture) mount versions also shall be available (e.g. nCM PDT 9 => nRM PDT9)

- B. Networked System Daylight (Photocell and or Dimming) Sensors
  1. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
  2. Photocell and dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.
  3. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).

4. Dimming sensors shall control 0 to 10 VDC dimmable ballasts by sinking up to 20 mA of class 2 current (typically 40 or more ballasts).
5. Photocell and dimming sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto set-point" setting.)
6. Combination units that have all features of on/off photocell and dimming sensors shall also be available.
7. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be capable of being controlled as an "offset" from the primary zone.
8. Line voltage versions of the above described photocell and combination photocell/dimming sensors shall be capable of switching both 120 VAC, 277 VAC, and 347 VAC. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load. Relays shall be dry contacts.
9. Sensor shall be the following Sensor Switch model numbers, with device options as specified:

nCM PC (on/off))

Note: Recessed mount versions of the above ceiling(fixture) mount versions also shall be available (e.g. nCM PC => nRM PC)

C. Networked System Power (Relay) Packs

1. Power Pack shall incorporate one or more Class 1 relays and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay(s), shall have an optional 2<sup>nd</sup> relay, 0-10 VDC dimming output, or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only, but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.
2. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC), be plenum rated, and provide Class 2 power to the system.
3. All devices shall have two RJ-45 ports.
4. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
5. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
6. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
7. Power (Secondary) Packs shall be available that provide up to 16 Amp switching of all lighting load types.
8. Power (Relay) Packs and Supplies shall be the following Sensor Switch model Series:  
nPP16 (Power Pack w/ 16A relay)

D. Networked System Wall Switches & Dimmers

1. Devices shall recess into single-gang switch box and fit a standard GFI opening.

2. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
3. All sensors shall have two RJ-45 ports.
4. All devices shall provide toggle switch control. Dimming control and low temperature/high humidity operation are available options.
5. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
6. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
7. Devices with mechanical push-buttons shall be made available with custom button labeling
8. Devices with a single on button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.
9. Wall switches & dimmers shall be the following Sensor Switch model numbers, with device options as specified:
  - nPODM (single on/off, push-buttons, LED user feedback)
  - nPODM 2P (dual on/off, push-buttons, LED user feedback)
  - nPODM 4P (quad on/off, push-buttons, LED user feedback)

E. Networked System Scene Controllers

1. Device shall have two to four buttons for selecting programmable lighting control profiles or acting as on/off switches.
2. Device shall recess into single-gang switch box and fit a standard GFI opening.
3. Devices shall provide LED user feedback.
4. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
5. All sensors shall have two RJ-45 ports.
6. Device shall be capable of reprogramming other devices in its zone so as to implement user selected lighting scene.
7. Device shall be capable of selecting a lighting profile be run by the system's upstream Gateway so as to implement selected lighting profile across multiple zones (and not just its local zone).
8. Device shall have LEDs indicating current selection.
9. Scene Selector device shall be the following Sensor Switch model number:
  - nPODM 2S (2 Scene, push-button)
  - nPODM 4S (4 Scene, push-button)

## 2.4 START-UP & SUPPORT FEATURES

- A. To facilitate start-up, all devices daisy-chained together (using CAT-5) shall automatically be grouped together into a functional lighting control zone.
- B. All lighting control zones shall be able to function according to default settings once adequate power is applied and before any system software is installed.
- C. Once software is installed, system shall be able to auto-discover all system devices without requiring any commissioning.
- D. All system devices shall be capable of being given user defined names.

- E. All devices within the network shall be able to have their firmware reprogrammed remotely and without being physically uninstalled for purposes of upgrading functionality at a later date.
- F. All sensor devices shall have the ability to detect improper communication wiring and blink its LED in a specific cadence as to alert installation/startup personnel.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's installation instructions.
- B. Provide complete installation of system in accordance with Contract Documents.
- C. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.
- D. Ensure that daylight sensor placement minimizes sensors view of electric light sources; ceiling mounted and fixture-mounted daylight sensors shall not have direct view of luminaries.

#### 3.2 CLEANING

- A. Clean all work under provisions of Division 01.
- B. Remove all dust and debris.

#### 3.3 DEMONSTRATION

- A. Provide complete systems demonstration to District personnel for a minimum of two (2) 6 hour demonstrations on different days as dictated by the District.

#### 3.4 AS-BUILT DOCUMENTATION

- A. Provide complete As-built documentation per 260010, 1.3 minimum.

### END OF SECTION



**SECTION 26 22 00**  
**LOW VOLTAGE TRANSFORMERS**

**PART 1 – GENERAL**

**1.1 SECTION INCLUDES**

- A. Type of transformers used and the associated electrical characteristics.
- B. Transformers shall be built in accordance with the latest ANSI (ASA), NEMA and IEEE Standards.
- B. Dry Type: Transformers below shall have Underwriters' Laboratories approval. All insulating materials used shall be in accordance with NEMA ST20 or NEMA TR27 Standards for a 220 degrees C insulation system.

**PART 2 – PRODUCTS**

**2.1 GENERAL CHARACTERISTICS - DRY TYPE**

- A. Voltage: Per the single line diagram and other information on the drawings.
- B. KVA: Per the drawings, capable of overload per ANSI C57.96.
- C. Ventilated dry type, 150 degrees C rise over a 40 degrees C ambient.
- D. Basic Impulse Level:  
  
600 volt and below - 10 KV
- E. Taps:  
  
5-25 KVA - 4 full capacity, two 2-1/2% above normal, two 2-1/2% below normal.  
  
Above 25 KVA - 6 full capacity, two 2-1/2% above normal, four 2-1/2% below.
- F. Maximum Sound Level, per ANSI C89.2.  
  

0-9	KVA	40 db
10-50	KVA	45 db
51-150	KVA	50 db
151-300	KVA	55 db
301-500	KVA	60 db
- G. Minimum Impedance:  
  

+0 - 50	KVA	2.0%
51 - 112½	KVA	3.0%
113 - 225	KVA	4.5%
226 - 500	KVA	5.0%
501 and over:	KVA	5.75%

H. Coil Design:

1. 600 Volt and Under: Continuous wound construction and impregnated with non-hygroscopic, thermosetting insulating varnish

I. Core Design:

1. The transformer cores are to be constructed of high grade, non-aging silicon steel laminations with high magnetic permeability, and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point. The core laminations shall be clamped securely with heavy, structural steel members. Core assemblies shall be internally isolated for low noise production.

J. Case Design:

1. The enclosure shall be constructed of heavy gauge sheet steel. All ventilating openings shall be in accordance with NEMA and National Electrical Code standards for ventilated enclosures. Provide with lifting devices bolted or welded to the base structure, and jacking pads designed to be flush with the enclosure. The base is to be constructed of structural steel members to permit skidding or rolling in any direction. The enclosure is to be cleaned, phosphatized, primed and finished with gray, baked enamel.
2. Terminal compartment shall be located in the bottom of the transformer to ensure termination of cable leads in ambient temperature levels and to provide for side or bottom entrance of conduit.
3. Transformers shall be manufactured by General Electric, Square D Company, Cutler - Hammer or International Transformer.

PART 3 – EXECUTION

3.1 MOUNTING

A. Dry Type:

1. Transformer shall be floor mounting on spring isolators which are specifically sized for the total weight of the unit and designed to minimize transmission of 120 hertz sound. The isolators shall also be designed to provide seismic restraint in a manner and to a degree acceptable to the Department of the State Architect.

3.2 CONNECTIONS

- A. Final connections to each dry type transformer shall be such as to minimize transmission of vibration. There shall be no rigid conduit or other metal to metal contact with the transformers which would transmit transformer generated noise away from the unit.

END OF SECTION 26 22 00

SECTION 26 24 16  
PANELBOARDS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Panel board description, minimum sheet steel, requirements and electrical characteristics.
- B. Panel boards shall be flush or surface mounting as indicated with sub-breakers as shown on panel schedules, hinged lockable doors, index card holders, engraved nameplates and proper bussing. Where indicated on the drawings, panelboards shall be furnished with subfeed breakers and/or lugs, split bussing, contactors, time switches, relays, etc., as required. Each panel shall be complete with a main breaker or a molded case switch of sufficient interrupting capacity.

PART 2 – PRODUCTS

2.1 STEEL GAUGE AND FINISH

- A. All panelboards shall be finished with one coat of zinc chromate and coat of primer sealer after a thorough cleaning where exposed to public view (e.g., corridors, covered passages, offices, etc.) and baked gray enamel in switchboard, janitor's, heater and storage rooms. Primer coated panelboards shall be painted to match surroundings after installation. Panelboards shall be fabricated of sheet steel of the following minimum gauges: Door and trim #12; Enclosure - code gauge steel.

2.2 KEYING

- A. All panelboards shall be furnished with flush locks using the manufacturer's standard lock and key. Door handles which extend beyond face of panel with integral locks will not be accepted for flush mounted panels but will be allowed on surface mounted panels.

2.3 CIRCUIT BREAKER WIRE TEMPERATURE RATING

- A. All circuit breakers shall be U.L. labeled as suitable for use with 60 degree/75 degree C or 75 degree C rated conductors.

2.4 CIRCUIT BREAKER FEATURES AND AUXILIARIES

- A. Where two or three pole breakers occur in the panels, they shall be common trip units. Single pole breakers with tie-bar between handles will not be accepted.

2.5 CIRCUIT BREAKER ARRANGEMENT

## SECTION 26 24-16

### PANELBOARDS

- A. Circuit breakers shall be arranged in the panels so that the breakers of the proper trip settings and numbers correspond to the numbering in the panel schedules on the drawings. Circuit numbers of breakers shall be black-on-white micarta tabs or other previously approved method. Circuit number tabs which can readily be changed from front of panel will not be accepted. Circuit number tabs shall not be attached to or be a part of the breaker.

#### 2.6 PANELBOARD AND CIRCUIT BREAKER IDENTIFICATION

- A. In addition to the engraved bakelite nameplate hereinbefore specified, panelboard manufacturer shall stencil the panel number or letter on inside of panel door to correspond with panel designation on drawings.
- B. Provide a red and white bakelite nameplate with 1/2" high letters in each 277/480 volt panel fastened to face of dead front plate, to read "WARNING 480 VOLTS."

#### 2.7 BUSSING

- A. Bussing shall be rectangular cross section copper or full length silver or tin plated aluminum.
- B. Each panelboard shall be equipped with a ground bus secured to the interior of the enclosure of sufficient size for the panel being used and shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

#### 2.8 SHORT CIRCUIT CAPACITY AND SERIES RATING

- A. All panelboards shall have bus bracing and circuit breaker fault interrupting capability to withstand and interrupt the available rms symmetrical fault currents indicated on the drawings. In no case, however, shall this capability be less than for 10,000 amperes at 208 volts and 14,000 amperes at 480 volts.
- B. When so indicated on the drawings or when not indicated but required to comply with paragraph "A" preceding the panelboard main breaker (or the feeder breaker ahead of the panel if so indicated) and the branch circuit breakers shall be U.L. approved and tested "SERIES RATED". The shop drawing submittal shall document this rating and its suitability based on the available fault currents shown or specified.
- C. When series rating is being applied to panelboards with main breakers (or feeder breakers if applicable) greater than 250 amperes, the branch circuit breakers shall be rated 22,000 amperes interrupting capacity, minimum or higher if required to coordinate under the series rating and for the available fault current indicated.

#### 2.9 MANUFACTURER

SECTION 26 24 16  
PANELBOARDS

- A. Lighting and appliance panelboards for 120/208 volt, three phase, 4 wire S/N shall be as hereinafter specified. Refer to AIC calculation and individual panelboard schedules for panelboard and circuit breaker AIC requirements.

General Electric .....Type AQ  
Square D .....Type NQOD

- B. Distribution panelboards for 120/208 volt, three phase, 4 wire shall be as hereinafter specified. Refer to AIC calculation and individual panelboard schedules for panelboard and circuit breaker AIC requirements.

General Electric .....Type CCB  
Square D .....Type I-Line

- C. Lighting panelboards for 277/480 volt, three phase, 4 wire S/N shall be as hereinafter specified. Refer to AIC calculation and individual panelboard schedules for panelboard and circuit breaker AIC requirements.

Square D .....Type NEHB  
General Electric .....Type AE

- D. Distribution panelboards for 480/277 volt, three phase, 4 wire shall be as hereinafter specified. Refer to AIC calculation and individual panelboard schedules for panelboard and circuit breaker AIC requirements.

General Electric .....Type CCB  
Square D .....Type I-Line

PART 3 – EXECUTION

3.1 COLOR CODING

- A. Wiring for branch circuits shall be color coded and shall be so noted on the directory in panels. The 277/480 volt wiring shall be color coded differently from the 120/208 volt wiring. The same color coding system shall be used throughout the entire job. Color coding shall be as follows:

120/208 Volt

Phase A hot leg .....black  
Phase B hot leg .....red  
Phase C hot leg.....blue  
Neutral .....white  
Switch legs .....purple

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PANELBOARDS

or other appropriate color.

277/480 Volt

Phase A hot leg.....yellow  
Phase B hot leg .....brown  
Phase C hot leg .....orange  
Neutral .....white

3.2 DIRECTORY

- A. Each panel shall have a neatly typewritten directory with the name and number of the room, area or the equipment served by each circuit breaker which shall correspond with the final circuit arrangement, including all addenda and change orders. Where rooms are provided with room numbers and/or nameplates, these same numbers and

names shall be used in lieu of those shown on the drawings. Spaces in directories for spare circuit breakers shall be neatly marked "Spare" in pencil. The directory shall also indicate the panel designation, voltage and phase at the top. Each directory shall be mounted in the index card holder behind a clear plastic window.

END OF SECTION 26 24 16

**SECTION 26 51 00  
LIGHTING FIXTURES**

**PART 1 – GENERAL**

**1.1 SECTIONS INCLUDES**

- A. Fixture descriptions, electrical and operating characteristics and installation requirements.
- B. Lighting fixtures shall have all parts and fittings necessary to completely and properly install the fixture. All fixtures shall be completely wired with conductors meeting applicable Underwriters' Laboratories requirements. All fixtures shall be equipped with lamps of size and type specified.
- C. All fixtures shall be complete with accessories, end caps, plaster frames, yokes, hangers, etc., which are required for the specific installations and physical conditions encountered in this project.
- D. The catalog numbers included in the description of the various types of lighting fixtures shall be basically considered to establish the type or class of the fixture with a particular manufacturer only. The fixture length, number of lamps, component materials, accessories and all other features required to fulfill the total description of the fixture based on all drawing and specification information shall be complied with regardless of whether or not the catalog number specifically includes these features. If any conflict exists between the catalog number and the description, the Contractor shall either resolve the conflict with the Architect prior to submittal of his bid or furnish the fixture to meet the intent as later interpreted by the Architect without change in contract price.

**PART 2 – PRODUCTS**

**2.1 PENDENT FIXTURES**

- A. All pendent stem mounting fixtures shall be supplied with swivel hanger and canopy assemblies providing 45 degree swiveling at top in any direction from plumb and meeting all other requirements of the Office of the State Architect and Table 23-P Part 2, Title 24, California Code of Regulations. Swivel and canopy assemblies shall also have approved hinged connection at bottom which shall be able to withstand at least 100% seismic longitudinal load without any permanent distortion or damage of metal. Hangers with the proper degree of swivel and labeled by the Los Angeles City Testing laboratory are acceptable to the Department of the State Architect.
- B. All swivel and canopy assemblies shall be suitable for the type of conduit mounting (surface or concealed) or the type of ceiling construction employed.
- C. For pendent fixtures, individual fixtures shall be suspended on two swivel assemblies, and continuous rows shall be suspended on one more hanger assembly than the number of fixtures.
- D. Each pendent mounted lighting fixture shall be with a safety cable or wire inside of each stem securely attached to the building structure at the top and to the fixture body at the bottom. The installed safety cable or wire shall be capable of supporting at least 4 times the fixture weight and shall be so tested, and the fixture shall be able to swing the full 45 degrees with this cable or wire installed. The Inspector shall verify this test and shall so state in his report.

**2.2 SURFACE MOUNTED FIXTURES**

- A. All surface mounted fixtures shall be suitable for mounting on low density material.

2.3 RECESSED FIXTURES

- A. All fixtures mounted in plastered ceilings shall be equipped with plaster frame.
- B. Recessed fixtures must have Underwriters' Laboratories labeling for through wiring.
- C. Recessed fixtures shall have Underwriters' Laboratories approved thermal protection (TP).

2.4 CONTINUOUS ROW FIXTURES

- A. Fixture catalog numbers called out hereinafter are for individual units. Where two or more units are combined for continuous row installation, the Contractor shall furnish and install the necessary accessories for the indicated requirements.

2.5 DIFFUSERS

- A. Unless noted otherwise, all lighting fixture diffuser shall be virgin acrylic plastic.
- B. All flat plastic diffusers shall be clear with male conical prisms and manufactured from clear virgin acrylic. Lens shall be as manufactured by Rohm & Haas Co., KSH or Continental Polymers. Nominal 2' x 4' or smaller lenses shall have a minimum unpenetrated depth of 0.1045" and a minimum overall thickness of 0.1875".
- C. Shaped acrylic lenses shall be manufactured from Rohm & Haas Plexiglas V, V Type 920 or VM, or approved equal using injection molding or extrusion.

PART 3 – EXECUTION

3.1 GENERAL

- A. Unless specifically indicated otherwise, all lighting fixtures and/or fixture stems shall be placed symmetrically with respect to the ceiling tile pattern or other architectural ceiling and wall modules.
- B. All fixtures of one type shall be of one manufacture and of identical finish and appearance.

END OF SECTION 26 51 00



**SECTION 27 51 26**  
**ASSISTIVE LISTENING SYSTEM**

**PART 1 - GENERAL**

**1.1 SCOPE**

- A. Work included: All labor, materials, appliances tools, equipment, facilities transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of the work of this Section. Complete as specified herein. Work includes, but is not necessarily limited to, the following:
  - 1. Examine all other sections for work related to those other sections and required to be included as work under this section.
  - 2. General provisions and requirements for electrical work.
- B. Conduit system, outlets, and related equipment shall be furnished and installed complete by the same contractor. All wiring shall be installed in a conduit system. The system shall be installed by the manufacturer's authorized installer. The entire system operation, function, testing, and maintenance for one year after final acceptance by the District, shall be the responsibility of the Contractor.
- C. The Contractor shall furnish and install all equipment, cables, devices, and other materials even though not specifically mentioned herein, which are necessary for the proper integration of the system, so that the system shall perform the function listed herein compliance with all the specified requirements.

**1.2 SUBMITTAL**

- A. Provide a current letter of recommendation from the manufacturer, addressed to LBUSD District. The contractor must be certified with the manufacturer for at least twelve (12) months prior to letter of recommendation. The letter of recommendation must be given to General Contractor at time of bid.
- B. Provide certification of the certified installer for this project at time of bid.
- C. Provide installer's experience and qualifications, which shall include three (3) years of projects of similar complexity. Include names and locations of two projects successfully completed using an instructional classroom technology.
- D. Provide documentation stating you have been in the telecommunication contracting business for a minimum of five (5) years under the same name and are located within a four (4) hour response time of the District.
- E. Complete bill of materials, including all quantities of components, devices, equipment, and wiring, required shall be submitted to complete this project.
- F. Complete bill of materials, including all quantities of components, devices, equipment, and wiring, required shall be submitted to complete this project.
- G. Manufacturer's specification sheets, model numbers of equipment, and descriptions of component operation shall be submitted.

**1.3 EQUIPMENT QUALIFICATION**

- A. The specification is based on the equipment of manufacturers who have been approved by the District, and the manufacturers herein named shall be considered as meeting the

requirements of this specification. For all items which are identified by part number and manufacturer, the performance specifications, which are published in the most recent manufacturer's data sheets, available at the time of bidding this project shall be applicable to the present work as though fully written out herein.

- B. All equipment shall conform to all federal, state, and local applicable codes and ordinances, and shall be listed by Underwriter Laboratories.

## PART 2 - PRODUCTS

- 2.1 Provide Assistive Listening System per CBC Section 11B-219 and shall comply with 11B-706. The minimum number of receivers shall be equal to 4% of the seating and as indicated in this section, but not less than two. The System is a FM Hearing Assistance System as manufactured by Phonic Ear or equal by William Sound. The system for Multi-purpose room shall include the following:
  - 2.2 Provide 1/2 wave 3 dB gain co-linear UHF ground-independent antenna, universal mounting bracket, tripod, and necessary coax cable on roof. Tripod to be provided under this section and installed by General Contractor. Verify exact location.
  - 2.3 Provide Assistive Listening System to include the following devices and additional devices as required by DSA:
    - A. (1) Transmitters, Catalog number PE 550T Base Station mounted in 19" rack. The base station shall operate at in 72 MHZ – 76 MHZ band and shall be furnished with remote mounted antenna to cover a minimum of 1000 ft.
    - B. (40) Receivers, Catalog number PE 300R Single Channel Receiver for use by the listener with standard Walkman-style headset AT541. Receiver must be capable of being clipped to a pocket or belt. Unit must be provided with two AA rechargeable nickel cadmium batteries.
    - C. (40) Ear-buds. 4) (1) Antennas, TELEX HGA-1, or equal (no known equal) 5) (4) Catalog number PE 300C Battery Charger Organizer. Unit must be capable of storing or recharging up to 12 receivers at one time. The charger must be capable of recharging the nickel cadmium batteries without removing the batteries from the receiver.
- 2.4 Provide the following IPA Accessories:
  - A. (1) Direct microphone compatible with TELEX system, ST-200, or equal (no known equal).
- 2.5 The system for the conference room shall include the following:
  - A. Four (4) Portable transmitter (as required by DSA), Telex TW 6, or equal (no known equal)

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. The installation shall be accomplished by and under the direction of skilled electronic craftsmen, factory trained by the equipment manufacturer, and experienced in the installation of systems of this type in the State of California. Workmanship shall be of the highest quality.

- B. Note that the general installation requirements of Division 26 00 00 apply to work performed under this Section.
- C. All wiring shall be neat and orderly. Disorganized "rats nests" of wire and cable will not be allowed. Terminal punch blocks and patch panels should be used for all system wire connections wherever possible, and all connections must be accessible. Absolutely no connections are to be made in wet locations or below grade.
- D. The conduit, outlet boxes, terminal cabinets, etc., which form a part of the rough-in work shall be furnished and installed complete as described and otherwise required in other sections of this Division 26 00 00 Specification.
- E. The balance of the system, including installation of the communication equipment, making all connections, etc., shall be performed by the manufacturer's authorized representative, and the entire responsibility for the proper operation, function, testing and complete maintenance for two (2) years after final acceptance by the Owner, shall be the responsibility of this subcontractor.
- F. During preparation for installation of any of the systems described in this Section of these Specifications and prior to ordering any material, coordinate all options and requirements with the Owner.
- G. Provide and install all cables as required specifically for each installation as needed for a complete and operable installation

### 3.2 TESTS, INSTRUCTION AND DOCUMENTATION

- A. The entire system shall be tested and adjusted under the supervision of the Contractor's electronics engineer.
  - 1. Provide all instruments for testing and demonstrate in the presence of the District's Representative that all telephone circuits and wiring are free of shorts and grounds and that the installation performs as required and is as specified herein.
  - 2. Program all control functions as needed. Coordinate all optional features of all systems with the Owner
  - 3. Any defects or abnormalities shall be corrected at once and the test re-conducted to demonstrate proper operation.
  - 4. A complete report of all these tests shall be prepared by the testing personnel and signed by them. The report shall include the date the testing was conducted a narrative describing each test and the results of all testing upon correction of all defects. The site inspector shall be informed of the testing schedule and his signature shall appear on the report attesting to the fact that these tests were conducted. The original copy of the final signed report shall be submitted to the Architect; and following his review, copies of the report shall be included in the operations and maintenance manuals provided to the Owner
- B. The equipment supplier/installer shall instruct the Owner or his designated representative(s) in the proper operation and maintenance of the system. Allow a minimum of four (4) hours for this on-site "hands-on" instruction. The Electronics Contractor shall provide sufficient personnel to provide adequate operations and maintenance training for all aspects of the system to the school staff.
  - 1. Approximately 30 days after final acceptance of the system, or as requested by the Owner, a follow up training session shall be scheduled at the site. Any special operating problems shall be resolved and the system shall be fully checked out and "fine tuned" as required. Allow a minimum of four (4) hours on site for the instruction portion of this requirement.

- C. Three complete sets of maintenance instructions, system/component data sheets and operating instructions shall be bound into three ring binders permanently labeled "Telephone Systems" and delivered to the Architect.
  - 1. Preface the Telephone Systems manuals with a typewritten sheet in a plastic protector identifying the system installer by business name, address and telephone number.
  - 2. The manuals shall include all approved submittal information, product data sheets, spare parts list, trouble shooting guides, complete "as- built" and one line diagrams, as necessary for the proper operation and servicing of the system. Provide an index to all material and indexing dividers for easy location of information.
- D. In addition to the three Maintenance and operations manuals described above, the following shall be provided:
  - 1. One manufacturer's operators manual for each telephone set provided plus five spares of each type.
  - 2. A one or two page (8-1/2"x 11") "Users Manual" suitable for photocopying and distribution to the teaching staff. This manual shall concisely describe the system features available (from the classroom) and provide specific operating instructions for utilizing these features. Cooperate with school administration in development of this reproducible "User's Manual".
- E. All original equipment documentation and manuals provided by the equipment manufacturers shall be safeguarded and turned over to the Owner at the completion of the project.

END OF SECTION 27 51 26

## **SECTION 27 60 PAVEMENT MARKING**

### **Part 1 GENERAL**

#### **1.1 SECTION INCLUDES**

- A.** Parking-stall line and curb painting.
- B.** Traffic symbols, directional arrows, lettering and safety zones, loading zone.
- C.** Accessibility signage.
- D.** Fire lanes.

#### **1.2 REFERENCES**

- A.** SSPWC - Standard Specifications for Public Works Construction, 2003 Edition.
- B.** AQMD - Air Quality Management District.
- C.** Fed. Std 595B - Colors Listed in Government Procurement.
- D.** CAS/CAR - California Accessibility Statutes and California Accessibility Regulations, January 2003 and 2001 California Building Code.

#### **1.3 SUBMITTALS**

- A.** Product data.
- B.** Shop drawing layout of complete parking lot, indicating stalls, lettering, safety zones, directional arrows, widths of lines and colors.

#### **1.4 QUALITY ASSURANCE**

- A.** Product Manufacturer: Company specializing in manufacturing quality traffic line paint products with ten years experience.
- B.** Applicator: Company specializing in commercial pavement painting with five years experience.
- C.** Regulatory Requirements
  - (1)** Conform to Federal Regulations concerning lead content of paints.
  - (2)** Conform to AQMD, Local Regulations. Copy of regulation is on file at Architect's office.

**SECTION 27 60  
PAVEMENT MARKING**

**D. Field Samples**

- (1) Provide field sample in form of one parking lot stall, illustrating coating color, width of stroke, thickness of application and dimensioning.
- (2) Locate where approved.
- (3) Accepted sample may remain as part of Work.
- (4) Do not proceed with pavement marking until sample panel has been approved.

**1.5 DELIVERY, STORAGE AND HANDLING**

- A.** Deliver products to site in sealed and labeled containers.
- B.** Container labeling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation and instructions for mixing and reducing.
- C.** Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, unless otherwise recommended by manufacturer.

**Part 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A.** Products of following manufacturers form basis for design and quality intended.
  - (1) Vista Paint Corporation, Fullerton, CA.
  - (2) Dunn-Edwards Corporation, Los Angeles, CA.
- B.** Or equal as approved in accordance with Division 1, General Requirements for Substitutions.

**2.2 MATERIALS**

- A.** Traffic Line Paint:
  - (1) Vista Paint: On-Line Traffic Paint.

## **SECTION 27 60 PAVEMENT MARKING**

- (2)** Dunn-Edwards: VIN-L-STRIPE TRAFFIC PAINT, VINYL EPOXY EMULSION, W801.
- B.** Striping, pavement markings, and curb markings in accordance with Sections 210-1 and 310-5.6 SSPWC.

### **2.3 COLORS**

- A.** Accessible Stalls and Signage: Blue, conforming to No. 15090 Fed. Std 595B.
- B.** Parking stalls, lettering, arrows, and traffic signage: White.
  - (1)** Parking spaces for disabled persons: Mark according to CBC Section 1129B.5.
  - (2)** Detectable Warnings Texture at Boarding Platforms: According to CBC Section 1133B.8.3 and 1133B.8.4. Detectable Directional Bars. As specified in Section 02750.
- C.** Stalls: Single line, 4 inches wide unless otherwise noted.
- D.** Fire Lanes: Red painted curb top and face, or paint 6 inch red strip if no curb. Paint 4-inch stenciled white letters on curb top and face, or strip indicating "Fire Lane - No Parking" at 20 feet on center.
- E.** Temporary Parking: Green painted curb top and face, with 4-inch stenciled white letters on curb top and face, indicating "Temporary Parking - 20 Minutes" at designated stalls.
- F.** Loading Zone: Yellow painted curb top and face, with 4-inch stenciled black letters
- G.** .on curb top and face, indicating "Loading Zone - No Parking" at 30 feet on center.

### **Part 3 EXECUTION**

#### **3.1 INSPECTION**

- A.** Verify that surfaces are ready to receive Work as instructed by product manufacture.

#### **3.2 APPLICATION**

**SECTION 27 60  
PAVEMENT MARKING**

- A.** Surfaces to be painted shall be clean and free of dust, dirt, grease, oil, water or other contaminants.
  - (1)** Existing lines to be removed shall be sandblasted clean.
- B.** Traffic paint shall not be applied until seal coat has been in place minimum of 10 days.
- C.** Apply material by machine spray, airless sprayer, roller or brush to provide a minimum thickness of 15 mils average. Precise edges required, no overspray allowed.
- D.** Perform Work in accordance with approved Shop Drawings. Conform to Section 310-5.6.8, SSPWC and CAS/CAR.
- E.** Mark parking spaces for disabled according to CBC Section 1129B.5.
- F.** Painted lines and markings on pavement shall be 4 inches minimum wide and blue In color equal to color No. 15090 per Federal Standard 595B.

**3.3 DEFECTIVE WORK**

- A.** Remove any paint that demonstrates evidence of checking, cracking, peeling, discoloration, lack of bonding or poor coverage. Misplaced lines shall be completely removed by paint remover or wet sandblasting per Section 310.5.6.3, SSPWC. Painting over misplaced lines will not be permitted.

**END OF SECTION**



**SECTION 28 00 00 –**

**INTELLIGENT FIRE DETECTION AND ALARM SYSTEM**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Manual and automatic fire alarm and smoke detection system.

**1.02 CONTRACTOR QUALIFICATIONS**

- A. All work specified in Section 28 00 00 shall be performed (furnished, installed and connected) by a Siemens Systems Company (NESCO). The fire alarm system contractor shall provide the following documentation to demonstrate compliance with the contract documents and qualifications. Documents shall be bound, indexed in the order listed below and provided during the submittal process. Equipment order, release or installation of any system components shall not occur without stamped approvals from the Project Architect.
1. Contractor's License: A copy of the electronics contractor's valid State of California License.
  2. Proof of Experience: Proof that the fire alarm contractor has been regularly engaged in the business of fire alarm contracting consisting of, but not limited to, engineering, fabrication, installation, and servicing of fire alarm systems of the type specified herein for at least the past ten (10) consecutive years. Provide a statement summarizing any pending litigation involving any officer or principal of/or the company, the nature of the litigation and what effect the litigation may carry as it relates to this work in the worst case scenario. Non-disclosure of this item, if later discovered, may result, at the Owner's discretion, in the contractor bearing all costs and any cost related to associated delays in the progress of the work.
  3. Insurance Certificates: Copy of fire alarm contractor's current liability insurance and state industrial insurance certificates in conformance with the contract documents.
  4. Project List: A List containing at least ten (10) California installations completed within the last five (5) years by the fire alarm contractor that are comparable in scope and nature to that specified in the contract document.
  5. Service Capability: Documentation indicating in detail that the fire alarm contractor has competent engineering, installation, service personnel and facilities with reasonable stock of service parts within 100 air miles of the job site.
  6. Authorization Letters: Letters from the fire alarm equipment manufacturer stating that the fire alarm contractor is the Factory Authorized Distributor, and is trained and certified for the equipment he proposes to use on this project, and is licensed to purchase and install that software required to provide the specified functions.
  7. Certification:
    - a. Proof that the fire alarm contractor is Underwriters Laboratories, Inc. (UL) listed under the classification of "PROTECTIVE SIGNALING SERVICES-LOCAL, AUXILIARY, REMOTE STATION AND PROPRIETARY (UUJS).

b. Copy of the following (NICET) Certificates. Proof that the certificate holders are a part of the fire alarm contractor's local facility servicing this project and will be actively involved in this project.

1) Certified Technologist or Registered Fire Protection Engineer.

2) Technician Level 4 minimum of (1)

8. Proof of Trained Personnel: Documentation that the fire alarm contractor has on staff personnel factory-trained and certified for the equipment proposed for this project. Also, a statement that personnel meeting these qualifications are in the local facility, and will be maintained at that facility throughout the project and the warranty period.

9. Copy of state of California issued Fire Alarm Certificate cards for all employees working on the project site. These shall be kept up to date at all times with the site / field construction manager.

#### 1.03 DESCRIPTION

A. This section of the specification includes the furnishing, installation, and connection of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciators, power supplies, and wiring as shown on the drawings and specified herein.

B. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for protected premised signaling systems, except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

C. The system is that of Silent Knight Company, substitutions will not be considered.

#### 1.04 CODES

A. The installation shall be made in accordance with the drawings, specification and the following:

1. National Electrical Code, Article 760

2. National Fire Protection Association Standards

3. California State Fire Marshall

4. U.L. 1971

5. Local Codes and Authorities having jurisdiction

6. Codes as listed on the drawings.

B. The system including all components shall be listed by the California State Fire Marshal (CSFM) and Underwriters Laboratories (UL) Inc. for use as a fire protective signaling system.

#### 1.05 APPROVALS

A. The system must have proper listing and/or approval from the following nationally recognized agencies:

UL Underwriters Laboratories, Inc.

CSFM California State Fire Marshal

FM Factory Mutual  
ISO International Standards Organization

- B. The Fire Alarm Contractor shall submit shop drawings to the Project Architect prior to the commencement of any fire alarm system work. Reference section 1.08 of this specification for submittal requirements.

1.06 RELATED WORK AND SPECIFICATIONS

- A. Documents affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and sections of Divisions 1 and 16 of these specifications.
- B. Basic Electrical Materials Section.
- C. Mechanical and Fire Protection Sections.
- D. Interface to Special Extinguishing Systems.

1.07 SCOPE

- A. Provide a new intelligent reporting, microprocessor controlled fire detection system. It shall be installed in accordance with the specifications and drawings.
- B. Provide all hardware, software, programming tools and documentation necessary to replace, modify or install new, the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site.
  - 1. The contractor shall have System Program Labels approved by District's Electronic Supervisor prior to programming the system.
  - 2. The contractor shall make, and include in his bid, all necessary provisions to maintain all existing fire alarm system warranties that are in place on this project site. Existing fire alarm system expansions completed by this contractor shall not void said warranties and this contractor shall warrant his work as defined under the descriptions of system warranties and guarantees of this specification.
- C. All required special programming equipment shall be furnished by the fire alarm contractor, turned over to the District and shall remain on site and shall be covered during the warranty period.
- D. Basic Performance:
  - 1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto a (Class B) signaling line circuit.
  - 2. Initiation device circuits shall be wired (Class B).
  - 3. Indication appliance circuits shall be wired (Class B).
  - 4. Digitized electronic signals shall employ check digits or multiple polling.

5. A Single ground or open on any system signaling line circuit, initiating device circuit, or indicating appliance circuit shall indicate a trouble condition at the control panel.
  6. Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.
- E. Basic System Functional Operation: When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
1. The system Alarm LED shall flash.
  2. A local signal in the control panel shall sound.
  3. Network annunciators shall display and indicate all information associated with the Fire Alarm condition, including the type of alarm point and its location within the protected premises.
  4. Printing and history storage equipment shall log the information associated with Fire alarm Control Panel condition, along with time and date of occurrence.
  5. All system output programs assigned via control by event equations to be activated by the particular point in alarm shall be executed, and the associated System Outputs (alarm indicating appliances and/or relays) shall be activated.
- F. Circuiting Guidelines:
1. All system smoke detectors shall be of the Addressable Analog type. Although each individual device point number and message shall be displayed on the LCD, the initiating devices shall be zoned as follows to provide the appropriate indication on the LED Annunciator.
  2. Provide one alarm initiating zone per device as shown on the plans and annunciator(s).
    - a. Manual stations per floor and building.
    - b. Area smoke detectors, heat detectors and beam detectors per floor and building.
    - c. Duct mounted smoke detectors, combination smoke/fire dampers and door hold devices per floor and building.
    - d. Special Extinguishing Systems.
    - e. Elevator recall and power disconnect.

1.08 SUBMITTALS

- A. Coordination Drawings: Prepare coordination drawings in accordance with the provisions in Section 01300.
- B. The construction documents have been designed based on School District Standards. The system shown on the drawings is a Silent Knight networked system.
- C. Submittal package shall be as follows

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1. Within thirty-five (35) calendar days after the date of award of the Contract, the Contractor shall submit eight (8) copies of the complete submission to the Architect for review.
2. The submission shall consist of five (5) major sections with each section separated with index tabs. Each page in the submission shall be numbered chronologically and shall be summarized in the index.
3. The first section shall be the "index" which shall include the project title and address, name of the firm submitting the proposal and name of the Architect.
4. The second section shall include the following items:
  - a. As indicated in Section 1.02 of this specification.
5. The third section shall contain the comparative specification listing, including a complete listing of the characteristics of the equipment to be furnished next to all of the specified equipment's features and functions as stated in the specifications and data sheets. Include CSFM listing sheet for each component.
6. The fourth section shall contain an original factory data sheet for every component in the specifications.
7. The fifth section shall contain a designation schedule for each Fire Alarm System device / component location and complete 1/8" = 1'-0" scale drawing showing system wiring plans.
  - a. Riser Diagram.
  - b. Typical Device Wiring Diagram.
  - c. Wire Legend.
  - d. Battery calculation for each control panel, power supply, field power supply and network annunciator.
  - e. Voltage drop for each notification circuit type per building.
  - f. Floor Plans showing all conduits, sizes and quantity of conductors.
  - g. Mounting Height of each devices and back box requirement.
  - h. Zoning and address description legend.
- D. Failure to comply with all of the requirements listed above will result in the rejection of the entire submittal package.
- E. The Contractor shall provide two (2) copies of an "Operating and Servicing Manual" for the system. The manuals shall be bound in flexible binders. All data shall be printed material or typewritten. Each manual shall include the following: Instructions necessary for the proper operation and servicing of the system; complete as-built installation drawings of the system; a wiring destination schedule for each circuit leaving for each piece of equipment; a schematic diagram of major components with all transistor and IC complements and replacement numbers.

Manual shall also include manufacturer's data sheets and installation manuals/instructions for all equipment supplied and installed

1.09 INSTALLATION COMPANY

- A. The fire alarm contractor shall be a UL listed company under the UL classification of (UUJS). The installation company shall UL certify this installation.
- B. The fire alarm contractor shall have a NICET Certified Engineering Technologist and Technicians on staff in their facility directly involved with this project to ensure technical expertise to this project and adherence with these specifications.
- C. The fire alarm contractor shall maintain sufficient stock on hand and have a fully equipped service organization capable of guaranteeing response time within eight (8) hours of service calls, twenty four (24) hours a day, seven (7) days a week to service completed systems.
- D. Equipment, wire and materials shall only be installed by the fire alarm contractor.
- E. The fire alarm contractor shall provide, install and test all equipment related to this section.

PART 2 - PRODUCTS

2.01 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

- A. All equipment shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on contract drawings and installation specifications shall be the best suited for the intended use and shall be provided by a single manufacturer. If provided by different manufacturers, system devices shall be recognized as compatible by both manufacturers and shall both receive equivalent warranties.

2.02 EQUIPMENT MANUFACTURERS

- A. The Fire Alarm System shall be limited to the following manufacturers and suppliers:
  - 1. Siemens.
- B. To ensure that compatibility and continuity is maintained throughout the existing School District, no other manufacturers or system suppliers will be considered.
- C. Fire alarm system manufacturer shall be ISO 9001 certified.

2.03 EQUIPMENT MANUFACTURERS

- A. Description: Provide a Silent Knight Intelligent Fire Detection and Alarm System as indicated on the plans.
- B. Mechanical Design:
  - 1. The control panel shall be housed in a UL cabinet designed for mounting directly to a wall or vertical surface. The back box shall be suitable for surface or flush mounting.

2. The door shall provide a key lock and shall include a transparent opening for viewing of all indicators.

C. System Capacity and General Operation:

1. Control panel shall be capable of accommodating all devices shown on the drawing and additional 50% initiating and alarm devices.
2. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display, individual, color coded system status LED's, and an alphanumeric keypad for the Field Programming and Control of the Fire Alarm System.
3. All programming or editing of the program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the Fire Alarm Control Panel.
4. The FACP shall provide the following features: Drift Compensation to extend detector accuracy over life. Sensitivity Test, meeting requirements of NFPA 72, Maintenance Alert Verification, with verification counters. PAS pre-signal, meeting NFPA 72 requirements. Rapid manual station reporting (under 2 seconds). Non-Alarm points for general (non-fire) control. Periodic Detector Test, conducted automatically by software. Pre-alarm for advanced fire warning. Counting "cross-zone" options. March time and temporal coding options. Walk Test, with check for two detectors set to same address. Security Monitor Points, meeting requirements of UL 1076. Control By Time for non-fire operations, with holidays. Day/Night automatic adjustment of detector sensitivity. Device Blink Control for sleeping areas.

D. Central Microprocessor:

1. The Microprocessor unit shall communicate with, monitor, and control all external interfaces with the control panel. It shall include EPROM for system program storage; non-volatile memory for building-specific program storage; and a "watch dog" timer circuit to detect and report microprocessor failure.
2. The Microprocessor unit shall contain and execute all control by event programs for specific action to be taken if an alarm condition is detected by the system. Such control by event programs shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
3. The Microprocessor Unit shall also provide a Real Time Clock for time annotation of system displays, printer, and history file. The Time of Day and date shall not be lost if system primary and secondary power supplies fail. The Real Time Clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.

E. Display:

1. The Display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
2. The Display shall include status information and custom alphanumeric labels for all Intelligent Detectors, Addressable Modules, and Software zones.

3. The Display shall provide an 80 character back-lit alphanumeric Liquid Crystal Display (LCD). It shall also provide Light Emitting Diodes (LED's), that will indicate the status of the following system parameters: AC POWER, SYSTEM ALARM, SYSTEM TROUBLE, SIGNAL SILENCED, SUPERVISORY, and PRE -ALARM.
  4. The Display shall provide key touch keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
  5. The Display shall include the following operator functions: SIGNAL SILENCE, RESET, DRILL, and ACKNOWLEDGE.
- F. SLC Loop Interface: The SLC Interface shall provide power to, and communicate with, all of the Intelligent/Addressable Detectors and Addressable Modules over a single pair of wires. This SLC Loop shall be capable of operation as NFPA Style 4, Style 6, or Style 7.
- G. Serial Interfaces:
1. An EIA-232 interface between the Fire Alarm Control Panel and UL Listed Electronic Data Processing (EDP) peripherals shall be provided (1AM-WF).
  2. The EIA-232 interface shall allow the use of printers, CRT monitors, and PC compatible computers.
  3. The EIA 485 port for the serial connection of the optional Annunciators and remote LCD displays shall be provided.
  4. The EIA-485 interface may be used for network connection to a Proprietary Receiving Unit.
- H. Field Charging Power Supply: The FCPS is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.
1. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 24-hour standby.
  2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two Style Y) shall be available for connection to the Notification devices.
  3. The Field Charging Power Supply shall include the ability to delay the AC fail delay per 1996 NFPA requirements.
  4. Provide quantity sufficient for a complete and operable system with no voltage drop to a signal device exceeding 8%.
- I. Printer:
1. Printers shall be of the automatic type, printing code, time, date, location, category, and condition.



2. The Printer shall provide hard copy printout of all changes in status of the system and shall time stamp such printouts with the current time of day and date. The printer shall be standard carriage with 80 characters per line and shall use standard pin feed paper.
3. The printer shall be enclosed in a separate cabinet suitable for placement on a desk top or table. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association standard EIA 232D. Power to the printer shall be 120 VAC 60 Hz.

J. Field Programming:

1. The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.
2. All programming may be accomplished through the standard FACP keypad.
3. All field defined programs shall be stored in non volatile memory.
4. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level is used for status level changes such as zone disabled or manual on/off commands. A second (higher-level) is used for actual change of program information.
5. A special program check function shall be provided to detect common operator errors.
6. An Auto-Program (self-learn) function shall be provided to quickly program initial functions and make the system operational.
7. An off-line programming function, with batch upload/download, shall also be provided.

2.04 SYSTEM COMPONENTS

A. Main Fire Alarm Control Panel (FACP)

1. Siemens (Existing – For reference only not required as part of scope)
2. Control Panel enclosure. (Existing – For reference only not required as part of scope)

B. Programmable Electronic Horns: (Indoor/Outdoor)

1. Electronic horns shall operate on 24 VDC nominal.
2. Shall be suitable for mounting on the wall or ceiling.
3. Shall be semi-flush or surface mounted as shown on plans.
4. Devices mounted on the exterior of buildings shall be installed as follows:
  - a. Flush mount device in a soundolier #193-8-6 backbox with a Soundolier VP-161 cover for all stud wall applications.

- b. Surface mount devices with manufacturer's listed weatherproof backbox for locations where flush mounting can not be utilized (such as concrete, block, brick or similar). Contractor shall notify Architect and engineer of record should such locations exist prior to mounting device. Surface mounted device shall be red in color.
  - 5. Manufacturer: Wheelock AH series
- C. Strobe Lights:
- 1. Shall operate on 24 VDC nominal.
  - 2. Shall meet the requirements of the ADA and UL 1971.
    - a. The maximum pulse duration shall be 2/10ths of one second
    - b. Intensity shall be as specified on the drawings.
    - c. The flash rate shall be one flash per every second.
    - d. The appliance shall be placed 80 inches to bottom of device above the highest floor level within the space, or 6 in below the ceiling, which ever is the lower.
    - e. Candela rating shall be as required per each space.
- D. Audible/Visual Combination Devices:
- 1. Shall meet the applicable requirements of section B listed above for audibility.
  - 2. Shall meet the requirements of section C listed above for visibility.
  - 3. Audible and visual devices shall operate on separate circuits for the expansion of existing systems in order to match existing site conditions. All new system components for audible and visual devices shall operate on a single notification circuit.
- E. Addressable Manual Stations:
- 1. Addressable Manual Stations shall be provided to connect to the Fire Alarm Control Panel Signaling Line Circuit (SLC) Loops.
  - 2. All operated stations shall have a positive, visual indication of operation that cannot be reset without the use of a key.
  - 2. Stations shall be suitable for surface mounting, or semiflush mounting as shown on the plans, and shall be installed at 48 inches above the finished floor.
  - 3. Shall comply with CBC Sections 1117B.6 and 1118b.
- F. Intelligent Photoelectric Smoke Detectors: (Low Profile)
- 1. Smoke detectors shall be intelligent and addressable devices, and shall connect with two wires to one of the Fire Alarm Control Panel Signaling Line Circuit loops.

2. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control pane, send data to the panel representing the analog level of smoke density.
3. The detector shall be ceiling mount and shall include a twist lock base.
4. The detector sensitivity shall be set through the Fire Alarm Control Panel, and shall be adjustable in the field through the field programming of the system. Sensitivity may be automatically adjusted by the panel on a time-of-day basis.
4. Detectors located above finished ceiling or in areas which are not readily visible shall be provided with remote indicator LED's.

G. Intelligent Heat Detectors

1. Heat Detectors shall be Intelligent and Addressable devices, and shall connect with two wires to one of the Fire Alarm Control Panel Signaling Line Circuits.
2. The detectors shall use and electronic sensor to measure thermal conditions caused by a fire.
3. The detectors shall be ceiling mount and shall include a twist lock base.
4. Detectors located above finished ceiling or in areas which are not readily visible shall be provided with remote indicator LED's.

H. Duct Smoke Detectors:

1. In-Duct Smoke Detector Housing shall be completed with an Intelligent Photoelectric Sensor, that provides continuous analog monitoring and alarm verification from the panel.
2. When sufficient smoke is sensed, and alarm signal is initiated at the FACP, and appropriate action taken to shut down air handling systems.
3. Detectors located above finished ceiling or in areas which are not readily visible shall be provided with remote indicator LED's.

I. Monitor Module:

1. Addressable Monitor modules shall be provided to connect one supervised IDC zone of conventional Alarm Initiating Devices (any NO. dry contact device) to one of the Fire Alarm Control Panel Signaling Line Circuit (SLC) Loops.
2. The Monitor Module shall mount in a 4-inch square, 2 1/8" deep electrical box.

J. Control Module:

1. Addressable Control Modules shall be provided control functions with Form "C" contracts.
2. The Control Module shall mount in a 4-inch square 2 1/8" deep electrical box.

K. Network Annunciator:

1. Furnish and install an alphanumeric, liquid crystal display, annunciators.
2. Shall be capable of displaying each individual addressable point. Minimum point capacity shall be not less than 200,000 points.
3. Provide a separate power supply and battery system for this annunciator.

2.05 BATTERIES

A. Battery:

1. Shall be Gel-Cell type.
2. Battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus five minutes of alarm upon a normal AC power failure.
3. The batteries are to be completely maintenance free.

2.06 CONDUIT AND SURFACE RACEWAY

- A. All conduit, surface raceways, outlet boxes, junction boxes, pull boxes, terminal cabinets, and similar devices required in this section of the work shall be provided under Division 16000 and as shown on drawings.
- B. Conduit and surface raceways shall comply with the requirements of Sections as described in the applicable specification sections.
- C. Conduit shall not enter the Fire Alarm Control Panel, or any other remotely mounted Control Panel equipment or backbox, except where conduit entry is specified by the FACP manufacturer.
- D. All fire alarm related conduits shall be clearly marked as "Fire Alarm System" and be painted red in color to indicate such system. Paint conduits with 6" red stripe every 36 inches minimum.

2.07 WIRE

- A. All low voltage wire required in this section shall be furnished and installed by the fire alarm contractor.
- B. All wire shall be installed in conduit. Wiring installed in underground conduits shall be approved for wet applications in accordance with the National Electric Code.
- C. All fire alarm system wiring shall be new.
- D. Wiring shall be in accordance with local stated and national codes (e.g., CEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 14 AWG for Initiating Device Circuits and Signaling Line Circuits, and 12 AWG for Indicating Appliance Circuits.
- E. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
- F. Wiring used for the multiplex communication loop shall be 18AWG twisted and shielded and installed in conduit. The system shall permit use of IDC and IAC wiring in the same conduit with the communication loop.

- G. All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; a trouble signal will be activated until the system and its associated field wiring are restored to normal condition.

## 2.08 TERMINAL CABINETS AND JUNCTION BOXES

- A. All boxes and cabinets shall be UL listed for their use and purpose.
- B. Terminal cabinets shall comply with the requirements of Section 16160 Terminal Cabinets.
- C. Provide terminal blocks for all conductors entering and/or exiting each terminal cabinet.

## PART 3 - EXECUTION

### 3.01 GENERAL INSTALLATION REQUIREMENTS

- A. The wiring of the system shall be executed in accordance with the drawings and the equipment manufacturer's wiring diagrams. Should any variations in these requirements occur, the contractor shall notify the architect before making any changes. It shall be the responsibility of the factory-authorized distributor of the approved equipment to install the equipment and guarantee the system to operate as per plans and specifications.
- B. Furnish all conduit, junction boxes, conductors, equipment plugs, terminal strips, etc., and labor to install a complete and operable system.
- C. The cables within the rack or cabinets shall be carefully cabled and laced with no. 12 Cord waxed linen lacing twine or ty-raps. All cables shall be numbered for identification.
- D. Splices of conductors in underground pull boxes is not permitted.
- E. The labor employed by the contractor shall be regularly employed in the installation and repair of communication systems and shall be acceptable to the owner and architect to engage in the installation and service of this system.
- F. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc., The contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., Caused by the performance of this work.
- G. The system must meet all local and other prevailing codes.
- H. All cabling installations shall be performed by qualified technicians.
- I. All cabling shall be splice free.
- J. In order to ensure the least amount of cable untwisting, it is required that all cables shall be stripped using a special tool.

- K. The use of lubricants (i.e. Yellow 77) to facilitate the installation of cables in conduits is highly discouraged. If such a lubricant must be used, the contractor shall verify the acceptability of the lubricant to be used with the cable manufacturer, prior to using such a lubricant.
- L. Under no circumstance are "channel locks" or other pliers to be used.
- M. All firewalls penetrated by structured cabling shall be sealed by use a non-permanent fire blanket or other method in compliance with the current edition of National Fire Protection Association (NFPA) and the National Electric Code (NEC) or other prevailing code. The contractor must not use concrete or other non-removable substance for fire stopping on cable trays, wireways or conduits. Contractors who use this method will be required to replace all cables affected and provide the original specified access to each effected area.
- N. Contractor shall furnish and install access panels, as required, for devices that require servicing, trouble shooting, testing, etc. Contractor shall coordinate all access panel sizes and locations with architect and other trades prior to rough in.

### 3.02 SPECIFIC INSTALLATION REQUIREMENTS

- A. The entire system shall be installed in a workmanlike manner in accordance with approved manufacturer's manuals and wiring diagrams. The contractor shall furnish all wiring, conduit, outlet boxes, junction boxes, terminal cabinets and similar devices necessary for the completed installation.
- B. Installation of conduit, outlet boxes, junction boxes, terminal cabinets, special back boxes and similar devices shall comply with the requirements of Division 16000 sections.
- C. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detector heads shall not be installed prior to the system programming and test period. If construction is on going during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- D. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas. Verify with the Project Architect prior to any surface mounted installations.
- E. All penetrations of floor slabs and fire walls shall be sleeved (1" conduit minimum) and fire stopped in accordance with the electrical specifications.
- F. Duct mounted Smoke Detectors shall be furnished and wired by this Contractor and installed by the Mechanical Contractor. All shutdown and interface wiring shall be performed by the Electrical Contractor. All air pressure differential testing shall be performed by the Mechanical/Air Balance Contractor.
- G. Sprinkler flow and tamper switches shall be furnished, installed and adjusted by the sprinkler contractor, wired and tested by this Contractor.

### 3.03 TESTING REQUIREMENTS

- A. Provide all instruments for testing and demonstrating in the presence of the owner's inspector that the frequency response is as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds.

B. All fire alarm testing shall be in accordance with NFPA 72.

C. The system shall be pre-tested and documented prior to the final inspection by the AHJ. The owner shall be notified of the pretest 48 hours in advance and shall witness this test if desired.

D. The pre-test shall include the following

1. All intelligent analog addressable devices shall be tested for current address, sensitivity and user defined message.
2. All wiring shall be tested for continuity, shorts and grounds before the system is activated.
3. Proper operation and execution of all its sequences.

E. At the final test and inspection, a factory-trained representative of the system manufacturer shall demonstrate to the Owner, his representative and the local fire inspector all its sequence of operations and any additional tests required by the AHJ. In the event the system does not operate properly, the test may be terminated. Corrections shall be made and the testing procedure shall be repeated until it is acceptable to the Owner, his representatives and the fire inspector.

F. Provide all instruments for testing and demonstrating in the presence of the owner's inspector that the frequency response is as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds.

G. Contractor shall provide all DSA required testing and certification at no cost to the Owner.

#### 3.04 TRAINING

A. The contractor shall include in his bid, all costs and charges (including travel, lodging, meals, etc...) required to provide factory certification, equal to that of a Factory Authorized Distributor for two (2) selected Owner's representatives. This training shall occur at the primary factory of the manufacturer and shall allow the selected Owner's representatives to provide any and all Factory / manufacturer Approved repairs, services, software upgrades, etc. without affecting any available or applicable Manufacturer Warranties.

B. The contractor shall provide not less than eight (8) hours for site instruction of personnel in the operation and maintenance of the installed systems. Instruction shall be documented and formalized for the Owner and/or Owner's representative. This instruction time shall be divided as directed by the Owner and made available at the completion of the project. This instruction is separate from that indicated in above Section 3.04.A.

1. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.
2. The instruction shall cover the schedule of maintenance required by NFPA 72 and any additional maintenance and testing procedures recommended by the system manufacturer and / or the Division of the State Architect (DSA).
3. Instruction shall be made available to the Local Municipal Fire Department if requested by the Local Authority having Jurisdiction.

- C. Contractor shall provide, and turn over to the Owner at the time of training, one (1) new lap top computer, complete with all hardware and software for the maintenance and testing of the installed fire alarm system. Contractor shall include in his training the use of these programs.

3.05 FINAL ACCEPTANCE

- A. The Owner or Owner's representative may visit the site during the installation of the system to ensure that correct installation practices are being followed.
- B. The Owner or Owner's representative will conduct a final job review once the contractor has finished the job. This review will take place within one week after the contractor notifies the owner.
- C. Two (2) copies of all certification data, as-built drawings and maintenance and operation manuals for all identifications shall be provided to the Owner before the owner's review.
  - 1. Maintenance and Operation manual shall contain
    - a. A detailed narrative description of the system architecture, inputs, notification signaling, auxiliary functions, annunciation, sequence of operations, expansion capability, application considerations and limitations.
    - b. Manufacturer's data sheets and installation manuals for all equipment supplied.
  - 2. As Built Project Drawings and Data
    - a. Drawings consisting of a scaled plan of each building showing the placement of each individual item of the Integrated Life Safety System equipment as well as raceway size and routing, junction boxes, and conductor size, quantity and color in each raceway.
    - b. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the Owner unless device addressing is electronically generated and automatically graphically self-documented by the system.
    - c. All drawings shall be provided in standard .dxf or AutoCAD format in addition to the (2) hard copies to be provided.
- D. The Owner or Owner's representative will review the installation and certification data prior to the system acceptance.
- E. The Owner or Owner's representative may test some of the systems features to ensure that the certification data is correct. If a substantial discrepancy is found, the Owner reserves the right to have an independent consultant perform a certification of the entire system. If such a procedure is undertaken, the cost of the testing will be billed back to the contractor.
- F. In the event that repairs or adjustments are necessary, the contractor shall make these repairs at his own expense. All repairs shall be completed within 10 days from the time they are discovered.



- G. The contractor shall hand to the owner a copy of any applicable installation specific software configurations in disk format.
- H. THE END-USER SHALL RETAIN COMPLETE RIGHTS AND OWNERSHIP TO ALL SOFTWARE RUNNING IN THE SYSTEM AT ALL TIMES. The application program listing (database) for the system, as installed at the time of acceptance by the building owner and/or local AHJ, shall be provided (disk and hard copy printout).
- I. A filled out Record of Completion, similar to the sample provided in NFPA 72, 2002, shall be turned over to the owner at the time of acceptance.

END OF SECTION 28 00 00

## **SECTION 31 22 00 GRADING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Provisions of Division 01 apply to this section.
- B. Section Includes:
  - 1. General exterior grading, cutting and filling, including grading for building area, paving, planting areas, banks and hillsides.

#### **1.2 SYSTEM DESCRIPTION**

- A. General:
  - 1. Fees: Pay as required by authorities having jurisdiction over the area.
  - 2. Bonds: Post as required by authorities having jurisdiction over the area.
  - 3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.
  - 4. Before grading, contact Underground Service Alert of Southern California (USASC) for information on buried utilities and pipelines.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. Materials shall conform to requirements specified in this and related sections.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Protect and maintain installed stakes until their removal is required for the Work. Provide replacement grade or location stakes lost or disturbed.
- B. Install grade stakes and compare to indicated grades. If discrepancies are found between existing grades and grades indicated on Drawings, do not proceed until discrepancies are resolved.

#### **3.2 ROUGH AND FINE GRADING**

- A. Rough grade area sufficiently high to require cutting by fine grading:
  - 1. Grade area for bituminous surfacing and other paving to the indicated

**SECTION 31 22 00  
GRADING**

grades, equal to the section of the indicated base and pavement.

2. Slope banks to required finish grades as cut progresses or leave cuts full and finish grade by mechanical equipment to provide grades and soil densities indicated on the Drawings.
3. Rough grade, fill and compact banks beyond indicated finish grades. Finish grade banks and slopes to indicated grades and specified soil densities.
4. Grade Only Areas: In areas not indicated to receive pavement, rough grade to approximate finish grades and then scarify, moisten and roll to obtain required density and indicated finish grades.
5. Tolerances: Finish grades shall be within a tolerance of 0.05 inch per foot above or below grades indicated. Provide an average grade as indicated.

**B. Base or Subgrade:**

1. After subgrade has been constructed to approximate required grades, scarify to a depth of at least 6 inches:
  - a. After scarifying, process loosened material to a finely divided condition and adjust moisture content to optimum condition by addition of water, addition and blending of dry suitable material, or by drying of existing material.
  - b. Subgrade material shall be compacted by tamping, sheepsfoot rollers or pneumatic tire rollers. Required relative compaction shall be 95 percent minimum for the top 6 inches below subgrade.
  - c. Base Course.
2. Tolerance of completed grades of base or subgrade shall not vary more than 0.03 inch per foot from grades indicated. Provide an average grade as indicated.

**3.3 SHORING**

- A. Provide shoring as necessary to properly and safely support earth sides of excavations, and existing curbs, sidewalks, gutter, drives and stairs, against movement and collapse.
- B. Design and Calculations: Provide in accordance with requirement of governing California Building Code and Safety Orders of State of California, Division of Industrial Safety; Title 8, Subchapter 4, Article 6, Sections 1530 and 1541.
- C. Remove shoring upon completion of the Work of this section or when no longer needed unless required otherwise by authorities having jurisdiction.

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**3.4            EXCESS MATERIAL DISPOSAL**

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

**3.5            PROTECTION**

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

**END OF SECTION**

**SECTION 31 23 00**  
**EXCAVATION, BACKFILLING and COMPACTING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Provisions of Division 01 apply to this section.
- B. Section Includes:
  - 1. Excavating, filling, backfilling, and compacting for Project site pavement, planting areas, buildings, and other structures.
  - 2. Trenches for utility lines such as water, gas, irrigation, storm drain and sewer lines, concrete-encased conduits, manholes, vaults, valve boxes, catch basins, underground tanks, thrust blocks, yard boxes, pull boxes, and other utility appurtenances.

**1.2 SYSTEM DESCRIPTION**

- A. Import and Export of Earth Materials:
  - 1. Fees: Pay as required by authorities having jurisdiction over the area.
  - 2. Bonds: Post as required by authorities having jurisdiction over the area.

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**EXCAVATION, BACKFILLING and COMPACTING**

3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

**1.3 SUBMITTALS**

- A. Imported Soils: A geotechnical engineer, retained by the Owner as an Owner Consultant, shall obtain initial product Sample for testing in accordance with the terms of sub-section 3.05 of this section.
- B. Shoring calculations as required in sub-section 3.03 of this section.

**1.4 QUALITY ASSURANCE**

- A. Comply with the Standard Specifications for Public Works Construction, current edition, except as modified herein.
- B. Sampling, testing, and certification of imported and/or exported soils shall be performed in accordance with Section 01440.

**1.5 PROJECT CONDITIONS**

- A. Information on Drawings or in soil investigation report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.
- B. A copy of the foundation investigation and soils report is available for examination at the Architect's office during regular office hours of Architect.

**PART 2 - PRODUCTS**

**2.1 FILL AND BACKFILL MATERIALS**

- A. Fill and backfill material shall be a granular material previously removed from excavation or imported fill material, free of clods and stones larger than 3 inches, (2½ inches for utility trenches) foreign materials, vegetable growths, sod, expansive soils, rubbish and debris. Material shall conform to these specified requirements and related sections.
- B. Fill material exhibiting a wide variation in consistency and/or moisture content shall be blended and/or aerated to stabilize and upgrade the material.
- C. Bedding material from trench bottom to one foot above the pipe:
  1. Sand, gravel, crushed aggregate or native free-draining granular material providing a sand equivalent of at least 30 or a coefficient of permeability greater than 1.4 inches per hour.
  2. Sand complying with the Specifications for cement concrete aggregates.
- D. Other Fill Materials: Brick rubble and broken concrete originating from the Project site may be legally disposed of off the Project site, or incorporated in fill, if reviewed by a geotechnical engineer, retained by the Owner as an Owner Consultant. Unless otherwise indicated, no such material shall be imported from outside the Project site.

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E. Permeable Backfill:

1. Provide permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations of these materials conforming to the following gradations:

<u>Sieve Size:</u>	<u>Percentage Passing:</u>
3/4 inch (19mm)	100
3/8 inch (10mm)	80-100
No. 100	0-8
No. 200	0-3

2. Those portions of fill material passing a No. 4 sieve shall provide a sand equivalent of at least 60.
3. Provided backing for weep-holes shall consist of 2 cu. ft. of aggregate in burlap sacks, securely tied. Aggregate shall conform to requirements for No. 3 concrete aggregate as specified in subsection 200-1.4 of the Standard Specifications for Public Works Construction.
4. Permeable Backfill Alternate Materials: Instead of the materials specified for retaining structures backfill, a drainage matting system such as Miradrain by Mirafi, Inc., or equal, may be provided if reviewed by the Architect.

- F. Cement-sand slurry shall be provided with 1 sack of cement per cubic yard of the mixture.

**2.02 BASE MATERIALS**

- A. Concrete Slabs on Grade: Provide "Crushed Aggregate Base" as specified in Standard Specifications for Public Works Construction, Section 200 - Rock Materials, with 3/4 inch maximum size aggregates. Provide 3 inch thick base, unless noted otherwise.
- B. Bituminous Surfacing: Provide as indicated on Drawings and specified in Section 32 11 23 - Base Course.

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. Before excavation, contact Underground Service Alert of Southern California (USASC) for information on buried utilities and pipelines.
- B. Where the Work includes a building extension or addition on an occupied Project site, perform Work in such a manner, and at such times, as not to disrupt performance of existing utility services to existing Project site facilities. Where an interruption is necessary, obtain review from the OAR before proceeding.
- C. Remove concrete or bituminous pavement to straight lines by saw cutting.

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**3.2 PROTECTION**

- A. Protect and guard excavations against danger to life, limb, and property as required by, but not limited to, OSHA regulations.
- B. Protect existing improvements including landscaping against damage. Repair or replace damaged items.
- C. Protect existing utility services and distribution systems from damage or displacement.
- D. Remove conduits or pipes not in service, exposed during Work, unless a minimum cover of 2 feet is provided. Remove concrete, clay or other non-metallic pipe over 8 inches in diameter, unless otherwise indicated.
- E. Shore, crib, or lag excavations and earthen banks as necessary to prevent cave in, erosion or gulying of sides.
- F. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. If soil becomes soft, soggy, or saturated, excavate to firm undisturbed earth and fill as required. Slope adjacent grades away from excavations to minimize entry of water.

**3.3 SHORING**

- A. Provide shoring as necessary to properly and safely support earth sides of excavations, and existing curbs, sidewalks, gutter, drives and stairs, against movement and collapse.
- B. Design and Calculations: Provide in accordance with requirement of governing California Building Code and Safety Orders of State of California, Division of Industrial Safety; Title 8, Subchapter 4, Article 6, Sections 1530 and 1541.
- C. Remove shoring upon completion of the Work of this section or when no longer needed unless required otherwise by authorities having jurisdiction.

**3.4 EXCAVATION**

- A. Unclassified Excavations: Comply with the Standard Specifications for Public Works Construction, Section 300: "Earthwork", except as modified herein.
- B. Form sides of footings, pads, grade beams, and slab foundations, unless otherwise indicated. Provide excavations of sufficient size to permit installation and removal of forms and other required Work.
- C. Machine-drill excavation for round footings to size and depth indicated. Provide a collar or casing, or other adequate protection, to exclude dirt and debris. Protect excavations with plank covers until concrete is placed.
- D. Provide excavation bottoms level and free from loose material. Excavate to indicated or required elevations of undisturbed earth.



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- E. Barricade trenches, ditches, pits, sumps, and similar Work outside the barricaded working area with chain link fence as specified in Section 01500: Construction Facilities and Temporary Controls, and in accord with Cal-OSHA standards and requirements.
- F. Trenches over 5 feet in depth shall comply with the Construction Safety Orders of the California Division of Industrial Safety.
- G. Where indicated and/or required to excavate in lawn areas, protect adjoining lawn areas outside of the Work area. Replace or install removed sod upon completion of backfill by installing sod level with adjacent lawns. If installation of removed sod fails, furnish sod and install to match existing lawns.
- H. For Structures:
  - 1. Calculate excavation quantities based on elevations or depths indicated on Drawings.
  - 2. Provide 2000 psi concrete for backfill of over-excavated areas to indicated or required elevations.
  - 3. Special preparation of B.E.P. areas: Excavate areas designated on Drawings as bottom of excavated planes (B.E.P.), by excavating and filling to indicated grades and elevations.
- I. For Utilities:
  - 1. Excavate trenches to required depth for utility lines, such as pipes, conduits, and tanks, with minimum allowance of 6 inches at the bottom and 6 inches at the sides for bedding or concrete encasement as indicated on Drawings. Grade bottom of trenches to a uniform smooth surface. Remove loose soil from the excavation before placing sand bedding or concrete encasement.
  - 2. Do not install piping lengthwise under concrete walks without review by the Architect.
  - 3. Do not excavate trenches parallel to footings closer than 18 inches from the face of the footing or below a plane having a downward slope of 2 horizontal to one vertical, from a line 9 inches above bottom of footings.
    - a. Unless otherwise indicated on Drawings, depth of excavations outside buildings shall provide for a minimum coverage above top of piping, tank or conduit measured from the lowest adjoining finished grade, as follows:

Steel Pipe	24 inches below finish grade
Copper Water Tube	18 inches below finish grade
Cast-Iron, Pressure Pipe	36 inches below finished grade
Plastic Pipe (other than waste)	30 inches below finished grade
Tanks or other structure	36 inches below finished grade

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Soil, sewer & storm drain	minimum 18 inches below finished grade, and as required for proper pitch and traffic load. Install polypropylene sewer pipe with at least 24 inches of coverage.
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Irrigation Pipe:	Non-pressure pipe - 12 inches, pressure pipe - 24 inches.
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- b. Trench width shall provide space for fitting and joining. Excavate for piping bells and fittings, bell and spigot pipe and other fittings.
- 4. Where portions of existing structures, walks, paving, or other improvements are removed or cut for piping or conduit installation, replace the material with equal quality, finished to match adjoining existing improvements. Repair pavement as specified in Section 32 10 00 - Pavement Repair.
- 5. Provide a minimum clear dimension of 2 inches from sides of wall excavation to outer surfaces of buried pipes or conduits placed in the same trench or outside surfaces of containers and/or tanks.

**3.5 IMPORT/EXPORT OF MATERIALS**

- A. Unclassified Fill and Compaction: Comply with the Standard Specifications for Public Works Construction, Section 300 - Earthwork, except as modified herein. Install and compact fill in layers not to exceed 6 inches in thickness.
- B. Provide fill materials as specified in Part 2- Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.
- C. In addition to the requirements of this section, import and/or exported materials shall comply with the requirements of Section 32 24 00.
- D. Imported fill materials shall be sampled by a geotechnical engineer, retained by the Owner as an Owner Consultant, for compliance with the requirements of Part 2 of this section.
- E. A geotechnical engineer, retained by the Owner as an Owner Consultant, shall submit the samples to a independent DSA approved testing laboratory for testing.
- F. Initial sampling and testing shall be performed before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. A geotechnical engineer, retained by the Owner as a Owner Consultant, shall obtain both the initial and additional samples from the identified site and submit all samples for required testing.
- G. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported

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material. If the total quantity of import is determined to be less than 1000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.

- H. The independent approved testing laboratory shall perform the required tests and report results of all tests noting if the tested material passed or failed such tests and shall furnish copies to the PI, Architect, OAR, DSA, Contractor, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, Title 24, CCR and the DSA. Upon completion of the Work of this section, the independent testing laboratory and geotechnical engineer shall submit a verified report to the DSA as required by Title 24, CCR.
- I. Bills of lading or equivalent documentation will be submitted to the PI on a daily basis.
- J. Upon completion of import operations, provide the OAR a certification statement attesting that all imported material has been obtained from the identified source site.

**3.6 INSTALLATION OF MATERIALS**

- A. Pavement: Fill or backfill materials shall be installed in horizontal layers of 6 inches, unless otherwise required. Each layer shall be evenly placed and moistened or aerated as necessary. Unless otherwise reviewed by the geotechnical engineer, retained by the Owner as an Owner Consultant, each layer of fill material shall cover the length and width of the area to be filled before the next layer of material is installed. Top surface of each layer shall be installed to an approximate level with a crown or crossfall of at least 1 in 50, but not more than 1 in 20. Provide adequate drainage at all times during installation of the Work of this section.
- B. Structures:
  - 1. After concrete has been placed, forms removed, and concrete Work inspected, backfill excavations with earth to indicated or required grades. Backfill simultaneously on each side of walls or grade beams. Remove rubbish, debris and other waste materials from excavations before placing backfill.
  - 2. Before placing any backfill, adequately cure concrete and provide bracing, if required to stabilize structure. Protect waterproofing or damp-proofing against damage during backfilling operations, with required protection board. Remove bracing as backfill operation progresses.
  - 3. Do not furnish or install expansive soils for retaining wall backfill.
  - 4. Rigidly control the amount of water to be installed to provide optimum moisture content for type of fill material furnished. Do not over-saturate or compact by flooding or jetting.
  - 5. Install wall backfill before installing railings and fences on walls.

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6. Install weep hole drainage at the backside of walls so the backing completely covers the weep holes, is horizontally centered and extends at least 12 inches above the bottom of the weep opening. Provide an 8 inch square section of 1/4 inch galvanized or aluminum screen, with a minimum wire diameter of 0.03 inch, and install at the backside of each weep hole before installing the backfill material.
  7. Where a reviewed drainage matting system is provided instead of permeable backfill for retaining structures, install in accordance with the manufacturer recommendations.
- C. Utilities:
1. Do not install backfill until the Work of this section has been inspected and tested. Do not furnish or install materials excavated from the Project site containing materials not permitted for backfill.
  2. Backfill electrical or other excavated utility trenches located outside of barricaded installation areas within 24 hours after inspection by the PI.
  3. Install backfill in layers not exceeding 4 inches in thickness, except cement-sand slurry.
  4. If materials excavated from the Project site are not permitted for trench backfill in paved areas, backfill trenches with a cement-sand slurry mix. Install backfill to an elevation of the existing undisturbed grades plus one inch.

**3.7 COMPACTING**

- A. Each layer of fill material shall be compacted by tamping, sheep foot rollers, or pneumatic-tired rollers to provide specified relative compaction. At inaccessible locations, provide specified compaction by manually held, operated and directed compaction equipment.
- B. Install and compact sand bedding to provide a uniform bearing under the full length of piping and conduits.
- C. Unless otherwise indicated, compact each layer of fill material to a relative compaction of at least 95 percent.
- D. When fill materials, or a combination of fill materials, are encountered or provided which develop densely packed surfaces as a result of installation or compacting operations, scarify each layer of compacted fill before installing the next succeeding layer.

**SECTION 31 23 00**  
**EXCAVATION, BACKFILLING and COMPACTING**

**3.8 INSPECTION AND TESTING**

- A. The geotechnical engineer, retained by the Owner as an Owner Consultant, will inspect and test excavations, sample material quality for testing as set required in Part 2, and observe installation/compaction of fill materials.
- B. The geotechnical engineer, retained by the Owner as an Owner Consultant, will sample imported fill materials from their designated source and submit all samples to the independent approved testing laboratory before delivery to the Project site.
- C. Installation of backfill shall be observed by the geotechnical engineer, retained by the Owner as an Owner Consultant.
- D. The geotechnical engineer, retained by the Owner as an Owner Consultant, will inspect and test excavation Work before the installation of fill and/or other materials.
- E. Compaction: Test compaction in accordance with ASTM D 1557, Method C.
- F. DSA will inspect foundation excavations when completed and ready for forms, after forms are in place, and before first placement of concrete.

**3.9 PROTECTION**

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

**3.10 CLEANING**

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

**END OF SECTION**

**SECTION 31 23 16**  
**EXCAVATION, BACKFILLING and COMPACTING for PAVEMENT**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Provisions of Division 01 apply to this section.
- B. Section Includes:
  - 1. Excavating, backfill, and compacting for paved areas.
  - 2. Installation of fill materials.

**1.2 SYSTEM DESCRIPTION**

- A. Import and Export of Earth Materials:
  - 1. Fees: Pay as required by authorities having jurisdiction over the area.
  - 2. Bonds: Post as required by authorities having jurisdiction over the area.
  - 3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

**1.3 SUBMITTALS**

- A. Imported Soils: A geotechnical engineer, retained by the Owner as a Owner Consultant, shall obtain initial product Sample for testing in accordance with the terms of sub-section 3.05 of this section.

**SECTION 31 23 16**  
**EXCAVATION, BACKFILLING and COMPACTING for PAVEMENT**

**1.4 QUALITY ASSURANCE**

- A. Comply with Standard Specifications for Public Works Construction, current edition, except as modified herein.
- B. Sampling, testing, and certification of imported and/or exported soils shall be performed in accordance with Section 32 24 00.

**1.5 PROJECT CONDITIONS**

- A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.
- B. A copy of the foundation investigation and soils report is available for examination at the Architect's office during regular office hours of Architect.

**PART 2 - PRODUCTS**

**2.1 BASE MATERIALS**

- A. Concrete Slabs On Grade: Provide "Crushed Aggregate Base " as specified in the Standard Specifications for Public Works Construction, Section 200: "Rock Materials," with  $\frac{3}{4}$  inch maximum size aggregates. Provide 3 inch thick base, unless noted otherwise.
- B. Bituminous Surfacing: As indicated on Drawings and specified in Section 32 11 23 - Base Course.

**2.2 FILL AND BACKFILL MATERIALS**

- A. Fill and backfill materials shall be previously excavated materials or imported fill material, free of clods and stones larger than 3 inches, foreign materials, vegetable growths, sod, expansive soils, rubbish and debris. Material shall conform to these specified requirements and related sections.
- B. Fill material exhibiting a wide variation in consistency and/or moisture content shall be blended and/or aerated to stabilize and upgrade the material.
- C. Imported Fill Material:
  - 1. Provide suitable materials obtained from Project site excavations for earthwork and fill materials. If excavated materials are not of suitable quality or sufficient quantity, import additional materials as necessary.
  - 2. Imported fill shall be a granular material with sufficient binder to form a firm and stable unyielding subgrade and shall not have more than 60 percent of fines passing 200 mesh sieve. Material shall have a coefficient of expansion of not more than 2 percent from air dry to optimum moisture content and not more than 6 percent from air dry to saturation. Imported material shall be clean and free of rubbish, debris, and toxic or hazardous contaminants. Adobe or clay soils are not permitted.

**SECTION 31 23 16**  
**EXCAVATION, BACKFILLING and COMPACTING for PAVEMENT**

- D. Other Fill Materials: Brick rubble and broken concrete originating from the Project site may be legally disposed of off the Project site or incorporated in fill, if reviewed by a geotechnical engineer, retained by the Owner as an Owner Consultant. Unless otherwise required, no such materials may be imported from outside the Project site.
- E. Permeable Backfill:
1. Provide permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations of these materials conforming to the following gradations:

Sieve Size:	Percentage Passing:
3/4 inch (19mm)	100
3/8 inch (10mm)	80-100
No. 100	0-8
No. 200	0-3
  2. Those portions of fill material passing a No. 4 sieve shall provide a sand equivalent of at least 60.
  3. Provided backing for weep-holes shall consist of 2 cu. ft. of aggregate in burlap sacks, securely tied. Aggregate shall conform to requirements for No. 3 concrete aggregate as specified in subsection 200-1.4 of the Standard Specifications for Public Works Construction.
  4. Permeable Backfill Alternate Materials: Instead of the materials specified for retaining structures backfill, a drainage matting system such as Miradrain by Mirafi, Inc., or equal, may be provided if reviewed by the Architect.

**PART 3 - EXECUTION**

**3.1 SITE PREPARATION**

- A. Clear the Project site as required in Section 31 10 00: Site Clearing.

**3.2 PROTECTION**

- A. Protect and guard excavations against danger to life, limb, and property as required by, but not limited to, OSHA regulations.
- B. Protect adjacent existing improvements including landscaping against damage.

**3.3 EXISTING UTILITY LINES**

- A. Protect existing utility lines from damage or displacement.
- B. Remove conduits or pipes not in service, exposed during Work, unless a minimum cover of 2 feet is provided. Remove concrete, clay or other non-metallic pipe over 8 inches in diameter, unless otherwise indicated.



**SECTION 31 23 16**  
**EXCAVATION, BACKFILLING and COMPACTING for PAVEMENT**

**3.04 EXCAVATION**

- A. Unclassified Excavations: Comply with the Standard Specifications for Public Works Construction, Section 300: "Earthwork," except as modified herein.

**3.05 FILL**

- A. Unclassified Fill and Compaction: Comply with the Standard Specifications for Public Works Construction, Section 300: "Earthwork," except as modified herein.
- B. Provide fill materials as specified in Part 2 – Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.
- C. In addition to the requirements of this section, import and/or exported materials shall comply with the requirements of Section 32 24 00.
- D. Imported fill materials shall be sampled by a geotechnical engineer, retained by the Owner as an Owner Consultant, for compliance with the requirements of Part 2 of this section.
- E. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall submit all samples to a DSA approved independent approved testing laboratory for testing.
- F. Initial sampling shall be performed by the geotechnical engineer, retained by the Owner as an Owner Consultant, before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall obtain both the initial and additional samples from the identified site and shall submit all samples to the approved independent testing laboratory for testing.
- G. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1000 cubic yards of material, one sample shall be obtained and submitted for testing tested for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.
- H. The independent approved testing laboratory shall perform the required tests and report results of all tests noting if the tested material passed or failed such tests and shall furnish copies to the PI, Architect, OAR, DSA, Contractor, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, Title 24, CCR and the DSA. Upon completion of the Work of this section, the independent testing laboratory and geotechnical engineer shall submit a verified report to the DSA as required by Title 24, CCR.

**SECTION 31 23 16**  
**EXCAVATION, BACKFILLING and COMPACTING for PAVEMENT**

- I. Bills of lading or equivalent documentation will be submitted to the IOR on a daily basis.
- J. Upon completion of import operations, provide the OAR a certification statement attesting that all imported material has been obtained from the identified source site.

**3.6 INSTALLATION OF MATERIALS**

- A. Fill or backfill materials shall be installed in horizontal layers of 6 inches, unless otherwise required. Each layer shall be evenly placed and moistened or aerated as necessary. Unless otherwise reviewed by the geotechnical engineer, retained by the Owner as an Owner Consultant, each layer of fill material shall cover the length and width of the area to be filled before the next layer of material is installed. Top surface of each layer shall be installed to an approximate level with a crown or crossfall of at least 1 in 50, but no more than 1 in 20. Provide adequate drainage at all times during construction of the Work of this section.

**3.7 COMPACTING**

- A. Each layer of fill material shall be compacted by tamping, sheepfoot rollers, or pneumatic-tired rollers to provide specified relative compaction. At inaccessible locations, provide specified compaction by manually held, operated and directed compaction equipment.
- B. Unless otherwise indicated, compact each layer of earth fill to a relative compaction of at least percent.
- C. When fill materials, or a combination of fill materials, are encountered or provided which develop densely packed surfaces as a result of installation or compacting operations, scarify each compacted layer before installing the next succeeding layer.

**3.8 INSPECTION AND TESTING**

- A. The geotechnical engineer, retained by the Owner as an Owner Consultant, will inspect and test excavations, sample material quality as required in Part 2, and observe installation and compaction of fill materials.
- B. The geotechnical engineer, retained by the Owner as an Owner Consultant, will sample imported fill materials from their designated source before delivery to the Project site.
- C. Installation of backfill shall be observed by the geotechnical engineer, retained by the Owner as an Owner Consultant.
- D. The geotechnical engineer, retained by the Owner as an Owner Consultant, will inspect and test excavation Work before the installation of fill and/or other materials.

**SECTION 31 23 16**  
**EXCAVATION, BACKFILLING and COMPACTING for PAVEMENT**

- E.      Compaction: Test compaction in accordance with ASTM D 1557, Method C.

**3.09            PROTECTION**

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

**3.10            CLEANING**

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

**END OF SECTION**

**SECTION 31 23 17**  
**EXCAVATION, BACKFILLING and COMPACTING for STRUCTURES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Provisions of Division 01 apply to this section.
- B. Section Includes:
  - 1. Excavating, backfilling, and compacting for buildings and structures.
  - 2. Fill materials.

**1.2 SYSTEM DESCRIPTION**

- A. Import and Export of Earth Materials:
  - 1. Fees: Pay as required by authorities having jurisdiction over the area.
  - 2. Bonds: Post as required by authorities having jurisdiction over the area.
  - 3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

**1.3 SUBMITTALS**

- A. Imported Soils: A geotechnical engineer, retained by the Owner as a Owner Consultant, shall obtain initial product Sample for testing in accordance with the terms of sub-section 3.05 of this section.
- B. Shoring calculations as required in sub-section 3.03 of this section.

**1.4 QUALITY ASSURANCE**

- A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction, current edition, except as modified herein.

**SECTION 31 23 17**  
**EXCAVATION, BACKFILLING and COMPACTING for STRUCTURES**

- B. Sampling, testing, and certification of imported and/or exported soils shall be performed in accordance with Section 01440.

**1.5 PROJECT CONDITIONS**

- A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.
- B. A copy of the foundation investigation and soils report is available for examination at the Architect's office during regular office hours of Architect.

**PART 2 - PRODUCTS**

**2.1 FILL AND BACKFILL MATERIALS**

- A. Fill and backfill materials shall be a granular material previously removed from excavation, or imported fill material, free of large clods and stones larger than 3 inches, foreign materials, vegetable growths, sod, expansive soils, rubbish and debris. Material shall conform to these specified requirements and related sections.
- B. Fill material exhibiting a wide variation in consistency and or moisture content shall be blended and/or aerated to stabilize and upgrade the material.
- C. Imported Fill Material:
  - 1. Provide suitable materials obtained from Project site excavations for earthwork and fill materials. If excavated materials are not of suitable quality or sufficient quantity, import additional materials as necessary.
  - 2. Imported fill shall be a granular material with sufficient binder to form a firm and stable unyielding subgrade and shall not have more than 60 percent of fines passing 200 mesh sieve. Material shall have a coefficient of expansion of not more than 2 percent from air dry to optimum moisture content and not more than 6 percent from air dry to saturation. Imported material shall be clean and free of rubbish, debris and toxic or hazardous contaminants. Adobe or clay soils are not permitted.
- D. Other Fill Materials: Brick rubble and broken concrete originating from the Project site may be legally disposed of off the Project site, or incorporated in fill, if reviewed by the geotechnical engineer, retained by the Owner as an Owner Consultant. Unless otherwise provided, no such materials may be imported from outside the Project site.
- E. Permeable Backfill:
  - 1. Provide permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations of these materials conforming to the following gradations:

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**EXCAVATION, BACKFILLING and COMPACTING for STRUCTURES**

<u>Sieve Size</u>	<u>Percentage Passing</u>
3/4 inch	100
3/8 inch	80-100
No. 100	0-8
No. 200	0-3

2. Those portions of fill material passing a No. 4 sieve shall provide a sand equivalent of at least 60.
3. Provided backing for weep-holes shall consist of 2 cu. ft. of aggregate in burlap sacks, securely tied. Aggregate shall conform to requirements for No. 3 concrete aggregate as specified in subsection 200-1.4 of the Standard Specifications for Public Works Construction.
4. Permeable Backfill Alternate Materials: Instead of the materials specified for retaining structures backfill, a drainage matting system such as Miradrain by Mirafi, Inc., or equal, may be provided if reviewed by the Architect.

**PART 3 - EXECUTION**

**3.1 SITE PREPARATION**

- A. Clear the Project site as required in Section 31 10 00: Site Clearing.

**3.2 PROTECTION**

- A. Protect and guard excavations against danger to life, limb, and property as required by, but not limited to, OSHA regulations.
- B. Protect adjacent existing improvements including landscaping against damage.
- C. Shore, crib, or lag excavations and earthen banks as necessary to prevent caving-in, erosion or gullyng of sides.
- D. Divert or de-water excavations until concrete is placed, forms are removed, and backfilling is complete.

**3.3 SHORING**

- A. Provide shoring as necessary to properly and safely support earth sides of excavations, curbs, sidewalks, gutter, drives and stairs, against movement and collapse.
- B. Design and Calculations: Provide in accordance with requirement of governing California Building Code and Safety Orders of State of California, Division of Industrial Safety, Title 8, Subchapter 4, Article 6, Sections 1530 and 1541.
- C. Remove shoring upon completion of Work, or when no longer needed, unless otherwise required by authorities having jurisdiction over the Work.

**SECTION 31 23 17**  
**EXCAVATION, BACKFILLING and COMPACTING for STRUCTURES**

**3.4 EXCAVATION**

- A. Form sides of footings, pads, grade beams, and slab foundations, unless otherwise indicated. Provide excavations of sufficient size to permit installation and removal of forms and other Work as required.
- B. Machine-drill excavation for round footings to size and depth indicated. Provide a collar or casing, or other adequate protection, to exclude dirt and debris. Protect excavations with plank covers until concrete is placed.
- C. Provide excavation bottoms level and free from loose material. Excavate to indicated or required elevations of undisturbed earth.
- D. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. If soil becomes soft, soggy, or saturated, excavate to firm undisturbed soil and fill as required. Slope adjacent grades away from excavations to minimize entry of water.
- E. Calculate excavation quantities based on elevations or depths indicated on Drawings.
- F. Provide 2000 psi concrete for backfill of over-excavated areas to indicated or required elevations.
- G. Special preparation of B.E.P. areas: Excavate areas designated on Drawings as bottom of excavated planes (B.E.P.), by excavating and filling to indicated grades and elevations.

**3.5 IMPORT/EXPORT OF MATERIALS**

- A. Provide fill materials as specified in Part 2- Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.
- B. In addition to the requirements of this section, import and/or exported materials shall comply with the requirements of Section 32 24 00.
- C. Imported fill materials shall be sampled by the geotechnical engineer, retained by the Owner as an Owner Consultant, for compliance with the requirements of Part 2 of this section.
- D. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall submit all samples to a DSA approved independent testing laboratory for testing.
- E. Initial sampling shall be performed by a geotechnical engineer, retained by the Owner as an Owner Consultant, before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall obtain both the initial sample and additional samples from the identified site and shall submit all samples to the approved independent testing laboratory for testing.

**SECTION 31 23 17**  
**EXCAVATION, BACKFILLING and COMPACTING for STRUCTURES**

- F. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.
- G. The independent approved testing laboratory shall perform the required tests and report results of all tests noting if the tested material passed or failed such tests and shall furnish copies to the PI, Architect, OAR, DSA, Contractor, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, Title 24, CCR and the DSA. Upon completion of the Work of this section, the independent testing laboratory and geotechnical engineer shall submit a verified report to the DSA as required by Title 24, CCR.
- H. Bills of lading or equivalent documentation will be submitted to the PI on a daily basis.
- I. Upon completion of import operations, provide the OAR a certification statement attesting that all imported material has been obtained from the identified source site.

**3.6 BACKFILLING**

- A. After concrete has been placed, forms removed and concrete Work inspected, backfill excavations to indicated or required grades. Backfill simultaneously on each side of walls or grade beams. Remove rubbish, debris, and other waste materials from excavations before placing backfill.
- B. Before installing any backfill, adequately cure concrete and provide bracing to stabilize structures. Protect waterproofing or dampproofing against damage during backfilling operations with required protection board. Remove bracing as backfill operation progresses.
- C. Do not furnish or install expansive soils for below grade building walls.
- D. Install each layer of material in a not to exceed thickness of 6 inches, unless otherwise required.
- E. Rigidly control the amount of water to be installed to provide optimum moisture content for type of fill material furnished. Do not over-saturate or compact by flooding or jetting.
- F. Install wall backfill before installing railings and fences on walls.



**SECTION 31 23 17**  
**EXCAVATION, BACKFILLING and COMPACTING for STRUCTURES**

- G. Impervious backfill materials shall be installed in layers along with and by the same methods specified for structure backfill. Impervious backfill materials shall be at the approximate grade and elevation and where exposed to erosion, shall be covered with at least a 12 inch layer of fill material as reviewed by the geotechnical engineer, retained by the Owner as an Owner Consultant.
- H. Install weep hole drainage at the backside of walls so the backing completely covers the weep holes, is horizontally centered and extends at least 12 inches above the bottom of the weep opening. Provide an 8 inch square section of 1/4 inch galvanized or aluminum screen, with a minimum wire diameter of 0.03 inch, and install at the backside of each weep hole before installing the backfill material.
- I. Where a reviewed drainage matting system is provided instead of permeable backfill for retaining structures, install in accordance with the manufacturer recommendations.

**3.7            COMPACTING**

- A. Compact each layer of fill material by tamping, sheepsfoot rollers or pneumatic-tired rollers, to such extent as to provide specified relative compaction. At inaccessible locations, compact to specified requirements with hand-held, operated and directed compaction equipment.
- B. Unless otherwise indicated, compact each layer of fill material to a relative compaction of at least 95 percent.
- C. Do not compact by flooding or jetting.
- D. When fill materials, or a combination of fill materials, are encountered or provided which develop densely packed surfaces as a result of installation or compacting operations, scarify each layer of compacted fill before installing the next succeeding layer.

**3.8            INSPECTION AND TESTING**

- A. The geotechnical engineer, retained by the Owner as an Owner Consultant, will inspect and test excavations, sample material quality as required in Part 2, and observe installation and compaction of fill materials.
- B. The geotechnical engineer, retained by the Owner as an Owner Consultant, will sample imported fill materials from their designated source before delivery to the Project site.
- C. Installation of backfill shall be observed by the geotechnical engineer, retained by the Owner as an Owner Consultant.

**SECTION 31 23 17**  
**EXCAVATION, BACKFILLING and COMPACTING for STRUCTURES**

- D. The geotechnical engineer, retained by the Owner as an Owner Consultant, will inspect and test excavation Work before the installation of fill and/or other materials.
- E. Compaction: Test compaction in accordance with ASTM D 1557, Method C.
- F. DSA will inspect foundation excavations when completed and ready for forms, after forms are in place and before first placement of concrete.

**3.9 PROTECTION**

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

**3.10 CLEANUP**

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

**END OF SECTION**

## **SECTION 32 10 00 PAVEMENT REPAIR**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Provisions of Division 01 apply to this section.
- B. Section Includes:
  - 1. Bituminous Surfacing Repair: Areas removed for utility trenches, heaved by tree roots, cracked areas, protruding areas where pavement meets hard surfaces, depressed areas, holes and areas around new structures, and raveled bituminous pavement.
  - 2. Concrete Pavement Repair: Areas heaved by tree roots, cracked areas, holes and trenches, and areas around new structures.

#### **1.02 SUBMITTALS**

- A. Shop Drawings: Submit Shop Drawings indicating areas to be repaired.
- B. Product Data: Submit manufacturer's technical data for materials and products.

#### **1.03 QUALITY ASSURANCE**

- A. Comply with Standard Specifications for Public Works Construction, current edition.

## **SECTION 32 10 00 PAVEMENT REPAIR**

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Materials specified in Section 31 11 23: Base Course.
- B. Materials specified in Section 32 12 16: Asphalt Concrete Paving.
- C. Materials specified in Section 32 12 17: Site Concrete Work.

#### **2.02 BITUMINOUS MATERIALS**

- A. Provide materials and products of the class, grade or type indicated, conforming to relevant provisions of Section 203 - Bituminous Materials of the latest Standard Specifications for Public Works Construction.

#### **2.03 HEADERS AND STAKES**

- A. Headers: Redwood, size 2 x 6, unless otherwise indicated on Drawings.
- B. Stakes: redwood, Construction Grade.
- C. Nails: Common, galvanized, 12d minimum.

#### **2.04 SLURRY**

- A. Cement-sand slurry; minimum one sack of cement per cubic yard of mixture.

### **PART 3 - EXECUTION**

#### **3.1 PAVEMENT REMOVAL**

- A. Remove bituminous and concrete pavement in accordance with applicable provisions of Section 300 - Earthwork of the Standard Specifications for Public Works Construction.
- B. Pavement Heaved By Roots: Remove pavement to limits of distortion and expose roots. Trim roots to provide at least 12 inches clearance to pavement.
- C. Remove protruding bituminous surfaces flush with the surrounding grade using a suitable tool or equipment so that adjacent finishes are not blackened.
- D. Remove raveled and depressed bituminous pavement to limits indicated or required.
- E. Saw cut existing improvements, trim holes and trenches in bituminous and concrete pavement to permit mechanical hand tampers to compact the fill.

## **SECTION 32 10 00 PAVEMENT REPAIR**

- F. Remove broken concrete by saw cutting. If the required cut line is within 30 inches of a score or joint line or edge, cut and remove to the score, joint line, or edge.

### **3.02 EXCAVATING, BACKFILLING AND COMPACTING**

- A. Conform to requirements in Section 31 23 00: Excavating, Backfilling and Compacting; Section 31 23 16: Excavating, Backfilling and Compacting for Pavement; Section 31 23 17: Excavating, Backfilling and Compacting for Structures.
- B. Where subgrade or base is deemed to be unstable or otherwise unsuitable, excavate such materials to firm earth, and replace with a required material. Install and compact fill materials in accordance with the requirements of related Specification sections.

### **3.03 HEADERS**

- A. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.
- B. Install headers so the bottom surface has continuous bearing on solid grade. Where excavation for headers is undercut, thoroughly tamp soil under the header. Compact backfill on both sides of header to the density of the adjacent undisturbed grade.
- C. Fasten headers in place with redwood stakes of length necessary to extend into solid earth a minimum of 12 inches. Stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4 feet on centers with top of stakes set one inch below top of header. Stakes are to be installed on the asphalt side of the header. Provide a minimum of 2-12d galvanized common nails through each stake.
- D. Remove existing headers where new surfacing is installed adjacent to existing surfacing.
- E. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.
- F. Provide additional stakes and devices as required to fasten headers.

### **3.04 BASE COURSE**

- A. Unless otherwise indicated, base course shall be crushed aggregate base, fine grade, 3 inches thick or equal to thickness of the existing base, whichever is greater.
- B. Fill grade and compact as specified in Section 31 22 00: Grading.

## **SECTION 32 10 00 PAVEMENT REPAIR**

### **3.5 RESURFACING**

- A. Holes and Trenches: Remove loose dirt and backfill with cement-sand slurry allowing for surfacing one inch thicker than existing. Unless otherwise indicated on Drawings, resurface flush with existing adjoining pavement installing the same type of materials and section provided in existing improvements.
- B. Other Areas: Other surface improvements damaged or removed shall be cut to a neat even line and excavated one inch below the bottom of the existing pavement. Resurface by following the original grades and installing the same type of materials provided in existing improvements.
- C. Where bituminous surfacing abuts concrete, masonry, walks or paving, tamp joint smooth, if necessary, as described above to obtain a uniformly even joint, true to line and grade. Tamp and smooth materials before asphalt cools.

### **3.6 REPAIRING AND RESEALING EXISTING SURFACES**

- A. Preparation of Surfaces: Prior to filling cracks, clean existing bituminous surfacing of loose and foreign materials and coat with a film of asphalt emulsion.
- B. Repair of Existing Surfacing:
  - 1. Fill cracks 1/2 inch wide and less with RS-1 emulsion and silica sand or other required material. Cracks larger than 1/2 inch wide shall be filled with Type C2 Asphalt Concrete as specified. Cracks shall be filled to the level of adjacent surfacing.
  - 2. Where low areas, holes, or depressions occur in existing surfacing, repair with emulsified asphalt. Install material, strike off the emulsified asphalt with a straightedge flush with adjoining surfacing. Finish with a steel trowel, and after dehydration, compact by rolling or tamping.
- C. Testing: Flood test entire area in presence of the PI. Entire area tested shall be free of standing water or puddles.
- D. Surface Seal: After surface has been repaired and tested, install seal coat over entire area indicated. Surface seal shall be as specified in Section 32 12 16.

**SECTION 32 10 00  
PAVEMENT REPAIR**

**3.07        CLEANING**

- A.     Remove all stains on the Project site and adjacent properties caused by or attributed to the Work of this section.
- B.     Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

**3.08        PROTECTION**

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

**END OF SECTION**

**Section 32 11 23  
BASE COURSE**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Provisions of Division 01 apply to this section.
- B. Section Includes:
  - 1. Installation of base material.

**1.02 SUBMITTALS**

- A. Prior to import, Contractor shall submit written certification to OAR that crushed Miscellaneous Base (CMB) does not contain Polychlorinated biphenyls (PCB) above laboratory detection limits when tested in accordance with EPA Method 8082, and obtain written approval from OAR and FUSD prior to import at the subject site, refer to article 2.02 for sampling frequency.,
- B. Crushed aggregate base (CAB) shall consist of native rock without naturally occurring asbestos or recycled materials. The Contractor shall submit written documentation, which identifies the source, volume, and proposed transport date of the material for review and approval by OAR and FUSD prior to importing the material. A statement on company letterhead from the source, stamped by either a California Professional Geologist or Engineer, which states that the subject materials are native rock, do not contain any recycled materials and that the source does not mine ultramafic materials, a source of natural occurring asbestos shall be included in the submittal to OAR and FUSD. To be considered for a variance, the Contractor shall submit a documentation package, which includes all of the aforementioned information at least 48 hours in advance of planned import.



**Section 32 11 23  
BASE COURSE**

1. Frequently used suppliers:
  - a. Hansen Aggregates, Inrwindale, California.
  - b. Vulcan Materials, Reliance Company, Irwindale, California.
  - c. Vulcan Materials Durbin, Irwindale, California.
- C. Product Data: Submit material source, technical information and test data for base materials. Gradation and quality certifications shall be dated within 30 days of the submittal.
- D. Sample: Submit Sample of proposed base course material.

**1.03            QUALITY ASSURANCE**

- A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction, current edition.

**PART 2 - PRODUCTS**

**2.01            UNTREATED BASE MATERIALS**

- A. The following base materials shall conform to the requirements of the Greenbook: Standard Specifications for Public Works Construction: Section 200 - Rock Materials.
  1. Crushed Aggregate Base.
  2. Crushed Miscellaneous Base.
    - a. CMB meeting requirements of article 1.02, A, may be used on-site for pavement base only.
    - b. CMB may be used off-site when in accordance to the Greenboook.
- B. Materials generated on site shall not be used as a base course material.

**2.01            SOURCE QUALITY CONTROL**

- A. Sampling and testing of imported and/or exported crushed miscellaneous base (CMB) shall be performed in accordance with the following Table 1 schedule:

**Section 32 11 23  
BASE COURSE**

TABLE 1: MINIMUM SAMPLING FREQUENCY	
Volume (CY)	Sampling Frequency
0 - 500	1 per 100 CY
501 - 1,000	1 per 250 CY
1,001 - 5,000	1 per 250 CY for first 1,000 CY 1 per 500 CY thereafter
5,001 - 20,000	12 samples for first 5,000 CY 1 per 1,000 CY thereafter
> 20,000	1 per 2,000 CY for first 20,000 CY 1 per 2,500 CY

**2.03 MATERIAL APPROVAL**

- A. Base material shall be inspected by the PI for gradation and material content prior to installation. The owner may choose to have additional tests performed by a geotechnical engineer, retained by the Owner, before installation.

**PART 3 – EXECUTION**

**3.01 INSTALLATION**

- A. Install base course material in layers not exceeding 4 inches in thickness, unless required otherwise. Grade and compact to indicated levels or grades, cut and fill, water and roll until the surface is hard and true to line, grade and required section. Provide a relative compaction of at least 95 percent, unless otherwise required.
- B. Grade base course to elevations indicated on Drawings, ready to receive surfacing, in accordance with Section 02310: Grading.

**3.02 PROTECTION**

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

**3.03 CLEANUP**

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

**END OF SECTION**

**SECTION 32 12 16**  
**ASPHALIC CONCRETE PAVING**

**GENERAL**

**1.1 SECTION INCLUDES**

- A.** Weed Killer.
- B.** Prepared base.
- C.** Headers and stakes.
- D.** Tack Coat.
- E.** Asphaltic concrete paving.
- F.** Pavement striping.
- G.** Concrete wheel stops.
- H.** Seal Coat

**1.2 REFERENCES**

- A.** Southern California Chapter, American Public Works Association - Standard Specifications for Public Works Construction (SSPWC) 1997 Edition and all Supplemental Amendments thereto.
- B.** Redwood Inspection Service - Standard Specifications for Grades of California Redwood Lumber.

**1.3 SUBMITTALS**

- A.** Certificates
  - (1)** Submit certificates of compliance from the supplier for bituminous materials for prime coat, paint binder, bituminous concrete, and seal coat under the provisions of Section 01 30 00.
  - (2)** Submit weigh master's certificates or certified delivery tickets for each truckload of bituminous material delivered to the project site.

Upon completion of the weed control treatment, and as a condition for final acceptance, Contractor to furnish a written certificate stating the brand name of the sterilant and the manufacturer, and that the sterilant used had at least

**SECTION 32 12 16**  
**ASPHALIC CONCRETE PAVING**

the minimum required concentration, and that the rate and method of application complied in every respect with the conditions and standards contained herein.

**B. Mix Designs**

- (1)** Submit mix designs for asphaltic concrete prepared by a materials laboratory under the direct supervision of a California Registered Engineer, or a standard mix design proven in actual performance.

**1.4 QUALITY ASSURANCE**

- A.** Perform work in accordance with Standard Specifications for Public Works Construction.
- B.** Mixing Plant Conform to State of California standards.
- C.** Obtain materials from same source throughout the project.
- D.** Paving along accessible route of travel to be slip resistance.

**1.5 REGULATORY REQUIREMENTS**

- A.** The quantity of Volatile Organic Compounds (VOC) used in weed killer, tack coat, primer and other materials shall not exceed the limits permitted under the current regulations of the South Coast Air Quality Management District.
- B.** Conform to applicable standards and specifications for paving work occurring on public property.

**1.6 TESTS**

- A.** Testing and analysis of granular base material and its compaction will be performed under provisions of Section 01 40 00.
- B.** Testing and analysis of asphaltic concrete pouring mix will be performed under provisions of Section 01 40 00.

**1.7 SITE CONDITIONS**

- A.** Apply asphaltic primer, asphaltic binder, and tack coat only when the ambient temperature is above 50 degrees F and when the temperature has not been below

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**ASPHALIC CONCRETE PAVING**

35 degrees F for 12 hours immediately before application.

- B.** Do not apply asphaltic materials when the base surface is wet or contains an excess of moisture, which would prevent uniform distribution and the required penetration.
- C.** Construct asphaltic concrete surface course only when the ambient temperature is above 40 degrees F, when the underlining base is dry and when it is not raining.
- D.** Protect existing concrete walks, curbs and bases, and other improvements adjacent to the Work. Repair damage areas caused by employees or equipment. Cover building and other surfaces with paper or other protection, where required.
- E.** Control established grades and maintain required lines and elevations. Joints shall be located at lane lines, where possible.

**Part 2     PRODUCTS**

**2.1         AGGREGATES**

- A.** Provide aggregates consisting of crushed aggregate base, or crushed slag base per 200-2.2 of the SSPWC.
- B.** Where asphaltic concrete thickness is 4 inches or greater the base course shall be 2 ½ inches thick and have a composition and grading of Class B per Section 203-6.3.2 of the SSPWC. The remaining surface course or courses shall have a composition and grading of Class C2, Section 203-6.3.2 of the SSPWC.
- C.** Where asphaltic concrete thickness is less than 4 inches the asphalt concrete shall have a composition and grading of Class C2, Section 203-6.3.2 of the SSPWC.
- D.** In hardscape play areas the asphalt concrete shall have a composition and grading of Class D2 Section 203-6.3.2 of the SSPWC.

**2.2         ASPHALT**

- A.** Asphaltic concrete shall be a Viscosity Grade of AR-4000 per Section 203-1 of the SSPWC.
- B.** Prime Coat shall be Liquid Asphalt, SC250 per Section 203-2 of the SSPWC.

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**ASPHALIC CONCRETE PAVING**

- C.** Tack Coat shall be Emulsified asphalt, SS-1h per Section 203-3 of the SSPWC.
- D.** Seal Coat shall be Vulcan Guardtop Asphalt Coating or equal.

**2.3 WEED KILLER**

- A.** Dry, free-flowing, dust-free chemical compound, nonflammable, not creating a fire hazard when applied in accordance with the manufacturer's recommendations, soluble in water, and capable of being spread dry or in solution.
- B.** Weed killer products
  - (1)** "Chlorax 40" Chipman Chemical Company, Inc., Palo Alto, California.
  - (2)** "Oust" E.I. Dupont de Nemours and Co.
  - (3)** "Casoron 50W" Uniroyal Chemical Co., Inc.

**2.4 HEADERS AND STAKES**

- A.** Headers: Redwood
- B.** Stakes: Redwood
- C.** Nails: Common, galvanized, 12d minimum.

**2.5 CONCRETE WHEEL STOPS**

- A.** Prefabricated 5-1/2 inch high x 7-1/2 inch wide x 48 inch long, 3,500 psi concrete wheel stop.

**2.6 PAVEMENT STRIPING PAINT**

- A.** Refer to Section 02760.

**Part 3 EXECUTION**

**3.1 INSPECTION**

- A.** Verify compacted sub-grade is dry and ready to support paving and imposed loads.  
Verify that sub-grade is compacted to 95% of maximum density.
- B.** Verify gradients and elevations of base are correct. The use of blue top stakes set by the surveyor to be used in areas lacking adjacent vertical controls.

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- A.** Beginning of installation means acceptance of substrate.
- B.** Verify gradients and elevations of crushed aggregate bases are correct.
- C.** Verify aggregate base course is unyielding to heavy loads.
- D.** Asphalt Mix temperature to be measured by the inspector to ensure placing temperature is not less than required by governing authority.

**3.2 PREPARATION**

- A.** Apply weed killer to entire area to be paved. Follow manufacturer's application directions.
- B.** Install headers and stakes to achieve arrangement of paving shown on the Drawings.
- C.** Stakes are to be placed on the inside of the header, so as to be buried by the asphalt.

**3.3 PLACEMENT OF CRUSHED AGGREGATE BASE COURSE**

- A.** Spread granular base material to compacted thickness shown on the Drawings.  
Compact according to Section 31 23 00 to 95 percent.
- B.** Thickness tolerance minus 0.5 inch to plus 0.5 inch.
- C.** Smoothness tolerance 3/8 inch in 10 feet.
  - (1)** Deviations shall be corrected by removing materials, replacing with new materials, and reworking or re-compacting as required.
- D.** Moisture content only the amount needed to achieve the specified compaction.

**3.4 PLACEMENT OF ASPHALTIC CONCRETE FINISHED PAVING**

- A.** Remove all loose materials from compacted base.
- B.** Apply tack coat at the rate of 0.05 to 0.10 gallon per square yard to all existing pavement, curbs, gutters, manholes and the like immediately before asphalt concrete is placed.
- C.** Adjust frames and covers, if so required, to meet final grades.
- D.** Spreading Concrete Materials:

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- (1)** Spread material with a self-propelled mechanical spreading and finishing machine designed specifically for that purpose.
- (2)** Spread asphaltic concrete to thickness required to achieve the compacted thickness shown on drawings.
- (3)** Asphaltic mix to remain in delivery truck until such time that equipment for the spreading is ready.
- (4)** Where thickness of asphaltic concrete paving will be 3 inches or less, spread in one layer.
- (5)** Where thickness of asphaltic concrete paving will be more than 3 inches, spread in two layers. Surface course shall be a minimum of 1 1/2 inch thick.
- (6)** Dikes and speed bumps to be placed with an extrusion machine or other equipment capable of shaping and compacting the material to the required cross-section.

**C. Rolling:**

- (1)** After material has been spread to proper depth, roll with a self propelled compacting roller per 302-5.6.1 of the SSPWC.
- (2)** Roll in at least two directions until no roller marks are visible.
- (3)** Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
- (4)** Finished paving smoothness tolerance

**3.2 CONCRETE WHEEL STOPS**

- A.** Place wheel stops at all parking stalls as indicated on plans.
- B.** Anchor permanently in place with two #4 steel rods 12 inches long.

**3.3 FIELD QUALITY CONTROL**

- A.** Field inspection and testing will be performed under provisions of Section 01400.



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**3.4 PROTECTION**

- B.** Immediately after placement, protect pavement under provisions of Section 01800 from mechanical injury for 2 days.
- C.** Protect all new placed asphaltic concrete from landscape irrigation overspray and planter area soil erosion.
- D.** Allow asphaltic concrete to dry for 30 days before applying seal coat.

**3.5 FLOOD TEST**

- A.** Before the seal coat is applied, a water flood test shall be made in the presence of the project inspector.
- B.** The flooding shall be done by water tank truck. Depressions discovered by flooding shall be corrected.
- C.** The slope shall be corrected to provide proper drainage. Fillings shall be done with hot materials only. The edges of the fill shall be feathered and smoothed so that the joint between the fill and the original surfacing is invisible.

**3.6 SEAL COAT**

- A.** After the flood test and patching has been completed and the surface has dried for a minimum of 30 days after placement of asphalt, a seal coat shall be applied as follows:
  - (1)** Prepare the surfaces, mix the seal coat material and apply in accordance with the manufacturer's recommendations as approved by the District.
  - (2)** Apply two coats of the specified sealer, allow drying time between coats.
  - (3)** Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, lap marks, ridges and other surface irregularities.

**SECTION 32 12 16  
ASPHALIC CONCRETE PAVING**

**3.7            CLEAN UP**

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

**END OF SECTION**

**SECTION 32 12 17**  
**SITE CONCRETE PAVING**

**I. PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Provisions of Division 01 apply to this section.
- B. Section Includes:
  - 1. Portland cement concrete pavement, cement walks, curbs, gutters, trash pick-up area, ramps, mowing strips, fence post footings, sliding gate concrete tracks, catch basins, pipe bedding and encasements, thrust blocks, transition structures, flagpoles and light standard bases and footings, athletic equipment footings and equipment pads.

**1.2 SUBMITTALS**

- A. Shop Drawings: Submit plans, elevations and details of concrete site Work.
- B. Product Data: Submit mix designs and manufacturer's technical data for materials and products. Submit 3" x 3" concrete Sample of each specified color. Material Sample: Submit one concrete bumper to the PI for destructive testing.

**1.3 QUALITY ASSURANCE**

- A. Comply with Standard Specifications For Public Works Construction.
- B. Paving along accessible route of travel to be slip resistance.

**II. PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Concrete, Mortar and Related Materials: Comply with applicable provisions of Standard Specifications for Public Works Construction, Section 201 - Concrete, Mortar and Related Materials:
  - 1. Concrete: 28-day compressive strength 2,500 psi, unless specified otherwise.
  - 2. Reinforcing Mesh: ASTM A 185, 4x4/W1.4 x W1.4 welded wire mesh.
  - 3. Expansion Joint Filler: Preformed expansion joint filler, bituminous type, complying with ASTM D 994.
- B. Form Materials:
  - 1. Side forms: Douglas fir, Construction Grade or Better or metal forms.

**SECTION 32 12 17**  
**SITE CONCRETE PAVING**

2. Stakes: Douglas fir, Construction Grade or Better or metal stakes.
- C. Concrete Parking Bumpers:
  1. Precast concrete, smooth and free of pits and rock pockets, providing a minimum 28-day compressive strength of 3,500 psi. Size at least 7-1/2 inches wide, 5-1/2 inches high and 6 feet long. Reinforce with 2 #5 reinforcing bars. Provide 2-3/4 inch diameter pre-drilled holes for anchor installation.
  2. Bumper Anchors: Provide 1/2-inch diameter x 18-inch long galvanized steel pipe.
  3. Bumper Adhesive: Provide adhesive recommended by bumper manufacturer/installer for fastening bumpers to concrete pavement.

**III. PART 3 - EXECUTION**

**3.1 CONSTRUCTION OF FORMS FOR CAST-IN-PLACE STRUCTURES**

- A. Concrete Pavement: Install Portland cement concrete pavement in compliance with the Standard Specifications for Public Works Construction, Section 302-Roadway Surfacing.
- B. Miscellaneous Exposed Concrete: Install concrete curbs, walks, gutters, cross gutters, access ramps, driveways, catch basins, yard boxes, vaults and similar structures, in compliance with the Standard Specifications for Public Works Construction, Section 303 - Concrete and Masonry Construction.
- C. Exposed Concrete Bases: Install bases, such as for post, flagpole, light standards and similar bases, in compliance with the Standard Specifications for Public Works Construction, Section 303 - Concrete and Masonry Construction.
- D. Post, flagpole, light standard footings below grade, underground conduit bedding, encasements, thrust blocks and similar structures may be placed \directly in excavations conforming to the required sizes.
- E. Reinforcement installation and concrete placement, surface finishes, curing and removal of forms shall be performed in compliance with applicable provisions of Standard Specifications for Public Works Construction, Section 303 - Concrete and Masonry Construction. Provide heavy broom finish at slopes exceeding six (6) percent and medium broom finish at slopes up to six (6) percent.

**3.02 INSTALLATION OF PARKING BUMPERS**

- A. Install bumpers as indicated on the Drawings. On bituminous paving, install anchors through pavement and into the ground a minimum of 12 inches. On concrete pavement, install bumpers in a continuous bed of adhesive.

**3.03 CLEAN UP**

**SECTION 32 12 17  
SITE CONCRETE PAVING**

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

**3.04 PROTECTION**

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

**END OF SECTION**

**SITE CONCRETE PAVING REINFORCEMENT**  
**Section 32 12 18**

**Part 1    GENERAL**

**1.1        SECTION INCLUDES**

- A.** Reinforcing steel bars and accessories for cast-in-place concrete.

**1.2        REFERENCES**

- A.** ACI 315 - Details and Detailing of Concrete Reinforcing.
- B.** ACI 318 - Building Code Requirements for Reinforced Concrete.
- C.** ASTM A82 – Standard Specification for Steel Wire, Plain, For Concrete Reinforcement.
- D.** ASTM A184 – Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
- E.** ASTM A185 – Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
- F.** ASTM A496 – Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
- G.** ASTM A497 – Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
- H.** ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- I.** ASTM A706 - Standard Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement.

**SITE CONCRETE PAVING REINFORCEMENT**  
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- J.** AWS D1.4 - Structural Welding Code for Reinforcing Steel.
- K.** CRSI - Concrete Reinforcing Steel Institute Manual of Practice.
- L.** Chapter 19A, California Building Code.

**1.3 SUBMITTALS**

- A.** Shop Drawings: Submit steel reinforcement Shop Drawings in accordance with ACI 315. Include assembly diagrams, bending charts and slab plans. Indicate lengths and location of splices, size and lengths of reinforcing steel.
- B.** Closeout Submittals: Record exact locations of reinforcing that vary from Shop Drawings.

**1.4 QUALITY ASSURANCE**

- A.** Provide Testing Laboratory with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.
- B.** Comply with the following as a minimum requirement:
  - 1. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice.
  - 2. American Welding Society (AWS)
  - 3. American Concrete Institute (ACI)
  - 4 CBC, Chapter 19A, Concrete
- C.** Source Quality Control: Refer to Division 01 Sections for general requirements and to the following paragraphs for specific procedures. Testing laboratory retained by the Owner shall select test Samples of Bars, ties, and stirrups from the material at the Project Site or from the place of distribution, with each Sample consisting of not less than two 18 inch long pieces, and perform the following tests according to ASTM A615, or ASTM A706, as applicable:
  - 1. Identified Bars: If Samples are obtained from bundles as delivered from the mill, identified as to heat number, accompanied by mill analyses and mill test reports,

**SITE CONCRETE PAVING REINFORCEMENT**  
**Section 32 12 18**

and properly tagged with the identification certificate so as to be readily identified, perform one tensile and one bend test for each 10 tons or fraction thereof of each size of bars. Submit mill reports when Samples are selected.

2. Unidentified Bars: When positive identification of reinforcing bars cannot be performed and when random Samples are obtained; perform tests for each 2.5 tons or fraction thereof, one tensile and one bend test from each size of bars.

**D.** Certification of Welders: Shop and project site welding shall be performed by welding operators certified by AWS.

**1.5 DELIVERY, STORAGE AND HANDLING**

- A.** Avoid exposure to dirt, moisture or conditions harmful to reinforcing material.
- B.** Reinforcing steel bars, wire, and wire fabric shall be stored on the Project site to permit easy access for examination and identification of each shipment. Material of each shipment shall be separated for size and shape.

**1.6 COORDINATION**

- C.** Coordinate with placement of formwork, formed openings and other Work.

**Part 2 PRODUCTS**

**2.1 MATERIALS**

- A.** Reinforcing Steel: ASTM A 615, or ASTM A706, 60 yield grade deformed low alloy steel for No. 4 bars or larger; 40 yield grade, No. 3 bars for ties and stirrups. Conform to Section 1903A, California Building Code 19A.
- B.** Welding Electrodes: Low Hydrogen grade E70XX for Grade 40, E90XX for Grade 60.

**2.2 ACCESSORY MATERIALS**

- A.** Tie Wire: Minimum 16 gage black annealed type.
- B.** Chairs, Bolsters, Bar Supports, and Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.
- C.** Special Chairs, Bolsters, Bar Supports, and Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type; size and shape as required.
- D.** Concrete Blocks: Approximately 3 inches dimension each side.

**2.3 FABRICATION**



**SITE CONCRETE PAVING REINFORCEMENT**  
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- A.** Fabricate concrete reinforcing in accordance with CRSI Manual of Practice and ACI 315 and ACI 318. Wherever possible, make bends to shape in fabricator's shop.
  - (1)** Bars reduced in section will not be accepted.
  - (2)** Bars with kinks are unacceptable.
  - (3)** Bars shall not be heated to facilitate bending or for any other purpose.
  - (4)** Bars with bends not indicated on drawings will not be accepted. Perform no forming in a manner which will damage bars.
- B.** Weld reinforcement in accordance with AWS D1.4.
- C.** Locate reinforcing splices not indicated on Drawings at point of minimum stress.

**Part 3 EXECUTION**

**3.1 PLACEMENT**

- A.** Place, support and secure reinforcement against displacement. Do not deviate from required position. Install concrete blocks to support reinforcement over grade. Smooth face rocks not permitted.
- B.** Do not displace or damage vapor barrier where vapor barrier is specified or indicated on drawings.
- C.** Accommodate placement of formed openings.
- D.** Prior to placing, thoroughly clean reinforcement of all rust, dirt, dust, oil or any other material deleterious to bonding of concrete.
- E.** Accurately place and securely tie reinforcement at all intersections and splices with black annealed wire and securely hold in position during placing of concrete by means of precast concrete block supports. Point wire tie ends away from the form. Unless otherwise indicated, the number, type, and spacing of supports shall conform to the ACI 315.
- F.** During placing of structural concrete slabs, provide a full-time reinforcing steel placer to repair and replace reinforcing to its proper location. Provide additional chairs of the proper size available to place under bars displaced during the concrete pouring operation.
- G.** Dowels for Walls: Securely tie in place prior to placing of concrete. Do not place dowels in concrete after pour.

**SITE CONCRETE PAVING REINFORCEMENT**  
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- H.** Dowels for Slabs: Securely tie in place prior to placing concrete. Per Plans or Drawings. Do not place dowels in concrete after pour.
- I.** Conform to Section 1907A, California Building Code for concrete cover over reinforcement.

**3.2 CLEAN UP**

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

**3.3 PROTECTION**

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

**END OF SECTION**

**Section 32 24 00**  
**ENVIRONMENTAL IMPORT/EXPORT MATERIALS TESTING**

**PART 1 – GENERAL**

This Section specifies the requirements for the sampling, testing, transportation and certification of imported fill materials or exported fill materials from school sites.

**1.1 SUMMARY**

- A. This Specification defines:
  - 1. CONTRACTOR requirements for use of existing, imported or generated materials on school sites.
  - 2. CONTRACTOR requirements for stockpiling materials for use on school sites.
  - 3. CONTRACTOR requirements for exporting materials from a school site including transportation.
  - 4. Testing requirements for all materials imported, exported stockpiled or generated for use on a school site.
  - 5. CONTRACTOR testing and reporting requirements.
  - 6. CONTRACTOR submittal requirements.

**1.2 OBJECTIVES**

- A. Ensure that fill materials imported to school sites are safe for students, staff and visitors.
- B. Ensure that materials exported from school sites for use at school and non-school sites or offsite disposal/recycling are adequately characterized for lawful disposition.
- C. Ensure that representative data be collected so that analytical determinations can be made in regard to the first two objectives.
- D. Require CONTRACTOR to contact with and pay for the services of a licensed environmental professional (licensed State of California Professional Engineer [PE Civil], Professional Geologist [PG] or Registered Environmental Assessor II [REA II]) familiar with environmental site assessment and waste classification and disposal requirements.
- E. Require CONTRACTOR to contract with and pay for an independent, approved California Department of Health Services certified testing laboratory to

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perform sampling and testing of imported, exported and site generated fill materials.

- F. Require CONTRACTOR to pay all fees required by authorities having jurisdiction over area.
- G. Require CONTRACTOR to post bonds required by authorities having jurisdiction over area.

**1.3 SUBMITTALS**

CONTRACTOR shall submit to OWNER'S Authorized Representative (OAR) for transmittal to FUSD.

- A. A qualifications statement for CONTRACTOR'S independent California certified testing laboratory and required licensed environmental professional (California Professional Engineer [PE civil]), Professional Geologist [PG] or Registered Environmental Assessor II [REA II] prior to the start of Work. CONTRACTOR'S licensed environmental professional must possess recent demonstrated environmental experience in soil sampling and waste classification.
- B. A draft import/export Sampling Strategy Plan (SSP) prepared by CONTRACTOR'S licensed environmental professional for review and concurrence by OAR and FUSD. The objective of the SSP is to obtain representative sample data. The Draft SSP must be submitted at least 72 hours prior to all proposed import/export sampling activities.

At a minimum, the Draft SSP shall include a site map which shows the location of the proposed import/export and the location and number of the proposed stockpile samples. The Draft SSP shall also contain information pertaining to the total volume of the stockpile proposed for sampling and the rationale in support of the proposed sampling approach. Existing

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environmental documentation specific to the import/export site shall be utilized by the CONTRACTOR'S environmental professional to support the proposed sampling approach and analytical method suite. For new school sites, this information would include a DTSC approved site investigation report, e.g., Preliminary Environmental Assessment (PEA). It is the responsibility of the CONTRACTOR to request this information in advance from the OAR if they do not already have access to a copy at the jobsite.

Lacking this information or rationale, samples shall be analyzed for all analytical methods described in Section 3.01. Guidance for the minimum number of samples per stockpile volume is provided in Table 1 (supplemental samples may be required by FUSD if pothole stockpile sampling is utilized.) In addition, the draft SSP shall contain all necessary contact information for the import/export site and a proposed schedule for the sampling activities.

To expedite the review process, the Draft SSP shall be submitted electronically to FUSD in MS WORD format.

Upon revision of the draft SSP by the CONTRACTOR'S licensed environmental professional and acceptance by OAR and FUSD four revised copies of the final SSP will be provided to the OAR for distribution to FUSD and the project file.

- C. A draft Certification/Sample Data Report prepared by CONTRACTOR'S licensed environmental professional for review and concurrence. At a minimum the draft Certification/Sample Data Report shall contain:
1. A site map showing the location of the stockpile and stockpile sample locations;
  2. A detailed discussion and evaluation of the laboratory results;
  3. A summary of findings and recommendations that provide a determination on the waste classification of the subject materials, based on the representative sample results;
  4. Recommendations for additional steps, if any;
  5. A chain-of-custody forms and all laboratory data with respective QA/QC sheets.

To expedite the review process, the Draft SSP shall be submitted electronically to FUSD in MS WORD format.

Upon revision of the draft Certification Report by the CONTRACTOR'S licensed environmental professional and acceptance by the OAR and FUSD three copies of the final report will be submitted to the OAR for distribution to FUSD and the project file and one copy to FUSD.

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- D. The Environmental Compliance Manager shall confirm that the proposed waste classification for the proposed import/export material is appropriate. For materials designated unacceptable for export except to a licensed facility, the Environmental Compliance Manager shall provide information on the necessary waste manifest documentation.
- E. Written documentation (e-mail is acceptable) verifying that all export soil for any soils exported for use at a non-school site, including the final Certification Report prepared by CONTRACTOR's licensed environment professional, were provided to provide to the proposed recipient prior to export and delivery.
- F. Written documentation, in the form of a memo or email from CONTRACTOR to OAR, prior to import/export, verifying that the hauling contract specifies 'clean' trucks and that the actual haul trucks utilized for import/export activities will be clean of visible contamination or deleterious materials.
- G. Written documentation that the trucks went directly from the source location to the recipient location with no detours or stops at other locations and that short loads were not augmented by other materials that were not tested as part of the final import/export SSP. It is the CONTRACTOR'S responsibility to document that no other trips or short-load augmentation occurred and submit the documentation within five (5) business days of the completion of the import/export activities. All import/export transportation activities shall be conducted in accordance with all applicable (local, State, Federal) rules and regulations.
- H. Certification, in the form of haul tickets or completed waste manifests, documenting the volume and recipient of all import/export materials and activities. This documentation shall be coordinated through the OAR, PI and FUSD.
  - 1. For approved import/export to new school sites, unregulated facilities (landfill) or non-school sites, haul tickets may be utilized, but shall contain the following minimum information:
    - Date of haul activity
    - Address of source
    - Address of recipient
    - Load volume
    - Time of departure from source
    - Time of arrival at recipient site
    - Signature of recipient or recipient's agent
  - 2. For export to regulated facilities (landfills, recyclers, etc.), the appropriate waste manifest must be completed and a copy of the executed manifest, signed by the receiving site, must be provided to the OAR. The waste

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manifest copy, signed by the receiving facility and based on the manifest address, will be sent directly to FUSD.

**1.4 APPROVALS**

- A. NO import or export of earth or geotechnical grading or filling materials can occur at FUSD sites without PRIOR approval by FUSD.

**PART 2 – PRODUCTS**

**2.1 MATERIALS**

A. Imported

1. Soils. Soils proposed for import shall be tested pursuant to the requirements of this Section (32 24 00), unless a variance has been requested by CONTRACTOR and approved by OAR and FUSD prior to the import of the subject materials.
2. Gravels. Clean gravel, consisting of native rock from a commercial source, may be granted a variance from the testing requirements of this Section provided a request for variance is submitted by CONTRACTOR for review and approval at least two weeks prior to import. CONTRACTOR shall provide written documentation, which identifies the source, volume and proposed transport date of the material for review and a letter signed and stamped from either a California Professional Engineer or Geologist stating the quarry does not mine ultra-mafic (i.e. natural asbestos containing) materials. The request for variance requires approval by OAR and FUSD prior to CONTRACTOR importing the materials.
3. Miscellaneous Material. No miscellaneous material containing crushed concrete, asphalt, construction debris, or other potential deleterious materials may be utilized or imported to FUSD project site for use as fill or grading materials of any sort without prior testing by CONTRACTOR pursuant to the subject Section (32 24 00) and approval by the OAR and FUSD.

B. Exported

1. Soils. Soils proposed for export shall be tested pursuant to the requirements of the subject section, unless a variance has been requested by CONTRACTOR and approved by OAR and FUSD prior to the import of the subject materials. (Note: Once soils or other materials for export have been tested, they cannot be disturbed or reused for any purpose without prior approval by the OAR and FUSD.
2. Gravels. Gravels or other natural rock material shall not be exported from a FUSD project without prior testing by CONTRACTOR pursuant to this Section (32 24 00) and/or approval by the OAR and FUSD.

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3. Miscellaneous Material. No miscellaneous material or other natural rock material shall not be exported from a FUSD project without prior testing by CONTRACTOR pursuant to this Section (32 24 00) and/or approval by the OAR and FUSD.
- C. Site Generated
1. Soils. Soils proposed for export shall be tested pursuant to the requirements of this Section (32 24 00), unless a variance has been requested by CONTRACTOR and approved by OAR and FUSD prior to the export of the subject materials. (Note: Once soils or other materials for export have been tested, they cannot be disturbed or reused for any purpose without prior approval by the OAR and FUSD.
  2. Gravels. Gravels or other natural rock materials shall not be exported from a FUSD project site without prior testing by CONTRACTOR pursuant to this Section (32 24 00) and/or approval by the OAR and FUSD.
  3. Miscellaneous Material. NO crushed miscellaneous material containing concrete, asphalt, construction debris, or other potential deleterious material that is generated onsite may be used as fill or grading material of any sort at a FUSD project site without prior testing and approval by OAR and FUSD. The onsite use of crushing equipment requires prior concurrence by OAR and FUSD. Crushed asphalt shall be segregated and stockpiled separately.
- D. Import and Export of fill Materials:
1. Fees: CONTRACTOR shall pay as required by authorities having jurisdiction over area.
  2. Bonds: CONTRACTOR shall post as required by authorities having jurisdiction over area.

**PART 3 - EXECUTION**

**3.1 SAMPLING AND TESTING**

- A. CONTRACTOR shall contract with, and pay for, the services of a licensed environmental professional (licensed State of California Professional Engineer [PE Civil], Professional Geologist [PG] or Registered Environmental Assessor II [REA II]).
- B. CONTRACTOR shall contract with, and pay for, and independent, approved California Department of Health Services certified testing laboratory to perform sampling and testing of imported, exported and site generated fill materials. [Note: Utilization of portable, onsite crushing equipment on FUSD sites also requires prior notification and approval by OAR and FUSD.]



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- C. All fill/grading material, unless otherwise specified in writing by OAR and FUSD whether imported or exported, must be tested at the site or origin. Import/export testing and certification process shall include the following steps:
1. Stockpile all materials for sampling (standard stockpile or backhoe pothole stockpile). Crushed fill materials generated by CONTRACTOR at a school site must be segregated by material. (e.g., separate stockpiles for concrete, asphalt. etc.)
  2. Submit Draft SSP for review and concurrence by OAR and FUSD.
  3. Collect and analyze samples (see Table 1 for number of samples per volume) per SSP. Once fill materials for export have been stockpiled and tested, they may not be used onsite for any purpose without prior approval by OAR and FUSD.
  4. Submit draft import/export sample data report for review and concurrence by OAR and FUSD.
  5. Submit final import/export sample data report (Certification Report to OAR and FUSD for concurrence or proposed waste classification. All certified material not utilized or exported within a period of 90 days will be subject to retesting unless a variance is requested by CONTRACTOR and is approved by OAR and FUSD prior to use or import/export of the subject materials.
  6. Submit required pre import/export documentation/record to the OAR (e-mail).
  7. Submit post import/export certifications to the OAR and FUSD.
  8. In addition to the preceding, requirements, certifications and submittals as indicated in previous subsections above.
- OWNER retains the right to refuse any fill materials proposed for use at a school site.
- D. Import/export fill materials shall be stockpiled by CONTRACTOR (or at export site) and are deemed acceptable for import/export or reuse only when it is demonstrated to the satisfaction of OAR and FUSD that the subject materials meet the requirements of this Section.
- E. As described in Section 1.03B, lacking site-specific data or sample rationale to support a more focused analytical approach; the CONTRACTOR shall analyze all samples for the following substances according to the methods indicated below. Table 3 is a waste classification flowchart for use by CONTRACTOR'S environmental professional. In all cases, detection levels and quality assurance/quality control methods shall be in accordance with standard Method reporting limits and best laboratory practices and the following USEPA

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(EPA) methods:

1. Total Petroleum Hydrocarbons, utilizing EPA Method 8015M, for gasoline and diesel.
  2. Volatile Organic Compounds, utilizing EPA Method 8260B/ 5035.
  3. Polychlorinated biphenyls, utilizing EPA Method 8082.
  4. Semi-Volatile Compounds, utilizing EPA Method 8270C.
  5. Organochlorine Pesticides, utilizing EPA Method 8081 A.
  6. Organophosphorous Pesticides, utilizing EPA Method 8141A.
  7. Chlorinated Herbicides, utilizing EPA Method 8151A.
  8. California Code of Regulations Title 22 (CAM 17) Metals, utilizing EPA Method 6010B/7470A.
  9. Hexavalent Chromium, utilizing EPA Method 7199.
  10. Arsenic/Thallium, utilizing EPA Method 6020.
- F. Import/export fill material may be deemed defective for use by FUSD at a school site if any of the following results are obtained.
1. Total Petroleum Hydrocarbons are present at concentrations exceeding 100 milligrams per kilogram (mg/kg) for gasoline and 1,000 mg/kg for oil/diesel and long chain hydrocarbons.
  2. Solvents and other volatile organic compounds are present at concentrations exceeding the laboratory reporting limit.
  3. Polychlorinated biphenyls are present at concentrations exceeding the laboratory reporting limit.
  4. Semi-volatile compounds are present at concentrations exceeding the laboratory reporting limit.
  5. Organochlorine pesticides are present at concentrations exceeding the laboratory reporting limit.
  6. Organophosphorous pesticides are present at concentrations exceeding the laboratory reporting limit.
  7. Chlorinated herbicides are present at concentrations exceeding the laboratory reporting limit.

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8. California Code of Regulations Title 22 (CAM 17) Metals at concentrations exceeding site-specific background.
  9. Hexavalent chromium is present at concentrations exceeding 15 mg/kg.
- G. Evaluate concentrations of metals in import fill by conducting the analysis set forth below.
1. Compare the maximum detected metal concentrations in import/export fill samples to the site-specific background levels provided in the site Preliminary Environmental Assessment (PEA) Report. The PEA Report shall be available from the OAR. If any metal concentration exceeds its listed background value, the fill material fails and shall be deemed defective and unacceptable for use unless supported by a site specific health risk assessment.
  2. In addition to section 3.01.G.1, import/export fill shall be deemed environmentally defective and unacceptable for use if any of the following results are obtained:
    - a. Arsenic concentrations exceed 12.0 mg/kg.
    - b. Lead concentration exceeds 255 mg/kg or fails TTLC/STLC.
    - c. Import/Export materials at new school sites with total lead concentrations greater than 50 mg/kg shall be analyzed for leachability (STLC/TTLC) prior to export. Materials exceeding STLC limits identified in Table 2 are deemed defective and unacceptable for use at school sites.
    - d. Import/Export materials at new school sites with total chromium concentrations greater than or equal to 100 mg/kg shall be tested for hexavalent chromium.
- H. All export/import fill material shall be characterized, handled, and documented in accordance with applicable US EPA and State of California hazardous waste and hazardous materials regulations (See Table 2). For the purpose of this specification, "contaminated" shall mean any soil or geotechnical material at a concentration, which would require disposal at a regulated facility (i.e., California hazardous or RCRA hazardous). OAR must be notified at least 72 hours prior to the disposal of any hazardous waste or hazardous material. No material disposal or reuse can take place without prior written approval of OAR and FUSD.
- I. Specification test results and OAR and FUSD approvals shall be valid for a period of 90 days from the date of the subject testing unless a variance is requested by CONTRACTOR and approved by OAR and FUSD. Previously

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approved materials shall not be utilized or disposed offsite after the 90 day limit without prior review and approval by OAR and FUSD.

- J. Requests for variances to this Specification shall be submitted in writing to OAR and FUSD a minimum of two weeks in advance of need for review and approval. The request for variance must provide all available testing data, a rationale to support the request and to have an active funding line (provided by OAR) to facilitate review by OAR and FUSD will review the request for variance and will provide its preliminary determination within two weeks. Certain requests may require final approval by the Department of Toxic Substances Control (DTSC).
- K. Soils with concentrations above Section screening levels may, upon prior approval by OAR and FUSD, be reused at other school sites if supported by a site-specific human health risk assessment.

**3.2 TRANSPORTATION**

- A. Details of the samples and testing must be submitted to and approved by OAR and FUSD before transportation.
- B. Haul Routes and Regulations/Restrictions: CONTRACTOR must comply with requirements of project EIR (CEQA) and authorities having jurisdiction over the project area and the proposed activities (e.g. Regional Water Quality Control Board, Department of Toxic Substances Control, etc.).
- C. CONTRACTOR shall pay all fees required by authorities having jurisdiction over area.
- D. Contractor shall pay all fees for disposal and/or processing of contaminated and/or hazardous fill materials at a regulated facility.
- E. CONTRACTOR shall post and pay for all bonds required by authorities having jurisdiction over area.

**END OF SECTION**

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**ENVIRONMENTAL IMPORT/EXPORT MATERIALS TESTING**

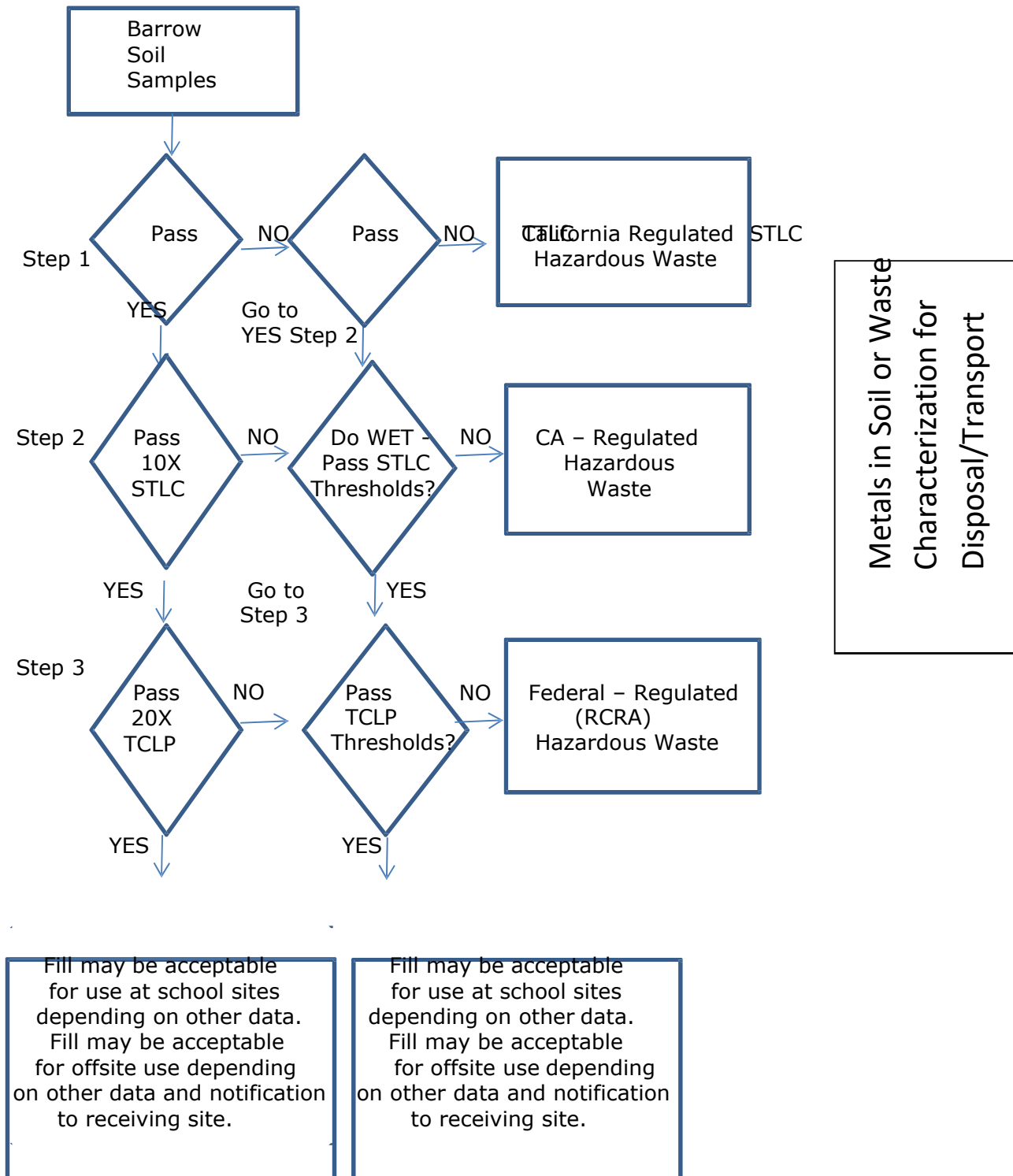
<b>TABLE 1: MINIMUM SAMPLING FREQUENCY</b>	
Volume (Cubic Yards)*	Sampling Frequency*
0-500	1 per 100 CY
501-1,000	1 per 250 CY
1,001-5,000	1 per 250 CY for first 1000 CY 1 per 500 CY thereafter
5,001-20,000	12 samples for first 5000 CY 1 per 1000 CY thereafter
> 20,000	MINIMUM 2 per 2000 CY for first 20,000 CY, 1 per 500 CY thereafter
<p>All samples are to be collected, analyzed and accepted before import/export: materials going to licensed facilities must meet sampling criteria from that facility. Pothole stockpile sampling may require discrete depth supplemental sampling in order to achieve representative results. The rationale for sample approach should be discussed in the draft SSP. In situ (in place) sampling by boring or hand auger is not acceptable.</p> <p>*Discuss alternative screening &amp; sampling approached with OAR and FUSD representative for project.</p>	

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Chemicals of Potential Concern	<b>TABLE 2 WASTE CHARACTERIZATION</b>				
	Hazardous Waste if Exceed Criteria – TTLC Level* (mg/kg)	Additional WET Leaching Tests if Exceed Hazardous Waste Criteria – 10 times STLC Level** (mg/kg)	California-Regulated Hazardous Waste-Soluble Threshold Limit Concentration – STLC Level (mg/l)	Additional TCLP Leaching Tests if Exceed Hazardous Waste Criteria – 20 times TCLP Level** (mg/kg)	Federally-Regulated (RCRA) Hazardous Waste – Toxicity Characteristics Leaching Procedure – TCLP Level (mg/l)
<b>CAM 17 Metals</b>					
Antimony	500	150	15	NA	NA
Arsenic	500	50	5	100	5
Barium	10,000	1,000	100	2,000	100
Beryllium	75	7.5	0.75	NA	NA
Cadmium	100	10	1	20	1
Chromium	2,500	50	5	100	5
Cobalt	8,000	800	80	NA	NA
Copper	2,500	250	25	NA	NA
Lead	1,000	50	5	100	5
Mercury	20	2	0.2	4	0.2
Molybdenum	3,500	3,500	350	NA	NA
Nickel	2,000	200	20	NA	NA
Selenium	100	10	1	20	1
Silver	500	50	5	100	5
Thallium	700	70	7	NA	NA
Vanadium	Vanadium	Vanadium	Vanadium	Vanadium	Vanadium
Zinc	Zinc	Zinc	Zinc	Zinc	Zinc
Chromium (VI)	Chromium (VI)	Chromium (VI)	Chromium (VI)	Chromium (VI)	Chromium (VI)

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**TABLE 3 – WASTE CLASSIFICATION FLOWCHART**



## **SECTION 33 14 16 SITE WATER DISTRIBUTION SYSTEMS**

### **- GENERAL**

#### **1.1 SUMMARY**

- A. Provisions of Division 01 apply to this section.
- B. Section Includes:
  - 1. Site water distribution systems located at least 5 feet outside the building perimeter, extending to an existing water line or meter.

#### **1.2 SUBMITTALS**

- A. Shop Drawings: Submit site plan indicating locations of lines, valves, and related appurtenances.
- B. Product Data: Manufacturer's catalog data for materials. Include technical data for accessories, gaskets, joints and couplings.
- C. Certificates: Certificates attesting that tests set forth in referenced publications have been performed, and the performance requirements have been satisfied.

#### **1.3 QUALITY ASSURANCE**

- A. Comply with the following as a minimum requirement:
  - 1. ANSI:
    - a. ANSI B16.18 Cast Copper Alloy Solder Joint Pressure Fittings.
    - b. ANSI B18.5.2.1M Metric Round Head Short Square Neck Bolts.
  - 2. ASME:
    - a. ASME B16.3 Malleable Iron Threaded Fittings.
    - b. ASME B16.4 Cast Iron Threaded Fittings.
    - c. ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
    - d. ASME B16.26 Cast Copper Alloy Fitting for Flared Copper Tubes.
    - e. ASME B18.2.2 Square and Hex Nuts (Inches Series).



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**SITE WATER DISTRIBUTION SYSTEMS**

- f. ASME B18.5.2M Metric Round Head Square Neck Bolts.
- 3. ASTM:
  - a. ASTM A 47 Ferric Malleable Iron Castings.
  - b. ASTM A 48 Gray Iron Castings.
  - c. ASTM A 53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
  - d. ASTM A 307 Carbon Steel bolts and Studs, 60,000 psi Tensile Strength.
  - e. ASTM A 563 Ductile Iron Castings.
  - f. ASTM A 563 Carbon and Alloy Steel Nuts.
  - g. ASTM B 61 Steam or Valve Bronze Castings.
  - h. ASTM B 62 Composition Bronze or Ounce Metal Castings.
  - i. ASTM B 88 Seamless Copper Water Tube.
  - j. ASTM C 94 Ready-Mixed Concrete.
  - k. ASTM D 1527 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80.
  - l. ASTM D 1785 Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.
  - m. ASTM D 2235 Solvent Cement for ABS Plastic Pipe, and Fittings.
  - n. ASTM D 2241 PVC Plastic Pipe Fittings, Schedule 40.
  - o. ASTM D 2282 ABS Plastic Pipe.
  - p. ASTM D 2466 PVC Plastic Pipe Fittings, Schedule 80.
  - q. ASTM D 2468 ABS Plastic Pipe Fittings, Schedule 40.
  - r. ASTM D 2564 PVC Plastic Piping Systems.
  - s. ASTM D 2774 Underground Installation of Thermoplastic Pressure Piping.
  - t. ASTM D 2855 Making Solvent-Cemented Joints with PVC Pipe and Fittings.

**SECTION 33 14 16**  
**SITE WATER DISTRIBUTION SYSTEMS**

- u. ASTM D 3139 Joints Pressure Pipes Using Flexible Elastomeric Seals.
  - v. ASTM F 402 Safe Handling Of Solvent Cements, Primer and Cleaners Used for Joining Thermoplastic Pipes and Fittings.
  - w. ASTM F 477 Elastomeric Seals for Joining Plastic Pipes.
4. American Water Works Association (AWWA) Standards:
- a. AWWA C104/A21.4 Cement-Mortar Lining For Ductile-Iron Pipe and Fittings For Water
  - b. AWWA C110/A21.10 Ductile-Iron and Gray-Iron Fittings, 3 inches through 48 inches, for Water and Other Liquids.
  - c. AWWA C111/A21.11 Rubber-Gasket Joints for Ductile-Iron pressure Pipe and Fittings.
  - d. AWWA C153/A21.53 Ductile-Iron Compact Fittings, 3 inches through 16 inches, for Water and Other Liquids.
  - e. AWWA C500 Gate Valves for Water and Sewage Systems.
  - f. AWWA C503 Wet- Barrel Fire Hydrants.
  - g. AWWA C508 Swing-Check Valves for Waterworks Service, 2 inches through 24 inches NPS.
  - h. AWWA C509 Resilient-wedge seated Gate Valves for Water and Sewerage Systems.
  - i. AWWA C511 Reduced-Pressure Principal Backflow-Prevention Assembly.
  - j. AWWA C600 Installation of Ductile-Iron Water Mains and Their Appurtenances.
- K. AWWA C651 Disinfecting Water Mains.
- i. AWWA C 800 Underground Service Line valves and Fittings.
  - m. AWWA C900 PVC Pressure Pipe, 4 inches through 12 inches, for Water Distribution.
  - n. AWWA M23 PVC Pipe - Design and Installation.
5. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry:

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- a. MSS SP-80 Bronze Gate, Globe, Angle and Check Valves.
- 6. Uni-Bell PVC Pipe Association (UBPPA):
  - a. UBPPA UNI-B-3 Installation of PVC Pressure Pipe.
  - b. UBPPA UNI-B-8 Direct Tapping of PVC Pressure Water Pipe.
  - c. UBPPA UNI-B-13 Standard Performance Specification on joined restrained devices for use with Poly Vinyl Chloride (PVC) Pipe.
- 7. Underwriters Laboratories Inc. (UL):
  - a. UL 246 Hydrants for Fire-Protection Service.
  - b. UL 262 Gate Valves for Fire-Protection Service.
  - c. UL 312 Check Valves for Fire-Protection Service.
  - d. UL 789 Indicator Posts for Fire-Protection Service.
- 8. National Pollutant Discharge Eliminations System (NPDES):
  - a. Comply with storm water requirements of general permit for storm water discharges when flushing pipe systems including storm drains and maintaining logs.
- B. Provide all valves from the same manufacturer.
- C. No pipe, pipe fitting, or any other fitting or fixture intended to convey or dispose water for human consumption for drinking or cooking is allowed in the domestic plumbing system, if they do not meet the low lead definition of Assembly Bill AB1953. Weighted average lead content of the wetted surface area of pipes, fittings and fixtures may not exceed 0.25%.

**1.4 PRODUCT HANDLING**

- A. Store items above ground on platforms, skids, or other required supports.
- B. Protect materials from direct sunlight.
- C. Protect coating and linings on piping, fittings, and accessories from damage. Repair and/or replace damaged coatings or linings.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Pipe:

## **SECTION 33 14 16 SITE WATER DISTRIBUTION SYSTEMS**

1. Pipe sizes up to 2.5 inches shall be copper water tubing, Type L hard, ANSI H23.1, ASTM B 88, IAPMO IS. Muller Brass, Cambridge-Lee Halstead, or equal.
  2. If soil report indicates corrosive condition, an approved protective wrap shall be used to completely isolate and protect all underground copper tubing and extend past the surface a minimum 12 inches. The excess wrapping shall be trimmed down and taped to copper tubing with 10 mill PVC pipe tape at grade level of concrete or asphalt.
  3. Underground pipe sizes 3 inches and larger shall be PVC water main pipe material complying with ASTM D 1784 Cell Class 12454B and AWWA C900. Piping shall be plain end or gasket bell end, pressure class 200 (DR14) with cast iron pipe equivalent OD.
  4. Stainless steel pipe, sizes 2 inch and larger may be used above or below ground with the approval of the Architect in lieu of copper, ductile iron, or plastic. Stainless steel pipe shall be schedule 10 or 304 above ground and schedule 316 below ground conforming to ASTM A312. Flanges shall be HR carbon steel plated conforming to ASTM A36. Flange exterior coating shall be Zinc plated conforming to ASTM B633-85. Welding wire/rod shall be 308L SS wire rod conforming to ASME SF A5.9.
    - a. Underground connections shall be welded s. s. pipe or made with a welded flange connection. Above ground connections may be with either flange or grooved Victaulic type coupler. Victaulic couplers shall be classified according to ANSI/NSF 61.
- B. Poly Vinyl Chloride (PVC) Water Main Fittings shall be gray-iron or ductile iron conforming to AWWA C110/A21.10 or AWWA C153/A21.53 and shall have cement mortar lining conforming to AWWA C104/A21.4, standard thickness unless otherwise indicated on Drawings. Fittings shall be mechanical joints.
- C. PVC Joints and Jointing Materials:
1. Pipe joints shall be push on as specified in ASTM D 3139.
  2. Joints between pipe and metal fittings, valves, and other accessories shall be mechanical joints as specified in AWWA C111/A21.11.
  3. Provide each joint connection with an elastomeric gasket suitable for the bell or coupling installation.
  4. Gaskets for push on joints for pipe shall conform to ASTM F 477.
  5. Gaskets for push on joints and compression type joints or mechanical joints for connections between pipes and metal fittings, valves, and other accessories shall be as specified in AWWA C111/A21.11.
  6. Sleeve-type mechanically coupled joints may be provided instead of push-on joints on plain-end PVC plastic joints. Comply with requirements of ASTM D 3139.

**NOTE: Gate valves in a domestic plumbing system intended to convey water for human consumption shall comply with quality assurance,**

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**SITE WATER DISTRIBUTION SYSTEMS**

**article 1.03C of this specification.**

**D. Gates Valves for PVC:**

1. Non-rising stem type with resilient wedge gates or iron body bronze wedge gates and mechanical joint ends conform to AWWA C500.
2. Non-rising stem type with mechanical joints ends shall conform to AWWA C509.
3. Valves designed for a working pressure of 175 psi shall be inside-screw type with operating nut, and resilient wedge type gate. Valve shall be provided with mechanical joints as required for the pipe to which it is intended to connect.
4. Valves with UL listing of 262 shall conform to AWWA C500. Valves shall open by counter-clockwise rotation of valve stem.
5. Stuffing boxes shall be provided with O-ring stem seals and shall be bolted and constructed to permit easy removal of parts for repair.
6. Sleeve type mechanical couplings may be provided instead of mechanical and push on joint ends.
7. Valve ends and gaskets for connection to sleeve type mechanical couplings shall conform to specified requirements for the joint or coupling.

**E. Gate Valves in Valve Pits:**

1. Outside screw and yoke rising stem type valves with resilient wedge gates and flanged ends shall conform to AWWA C500.
2. Outside screw and yoke rising stem type valves with flanged ends shall conform to AWWA C509.
3. Outside screw and yoke type Valves with double disc gates or split-wedge type gate and flanged ended ends shall be designed for 175 psi and conform to UL 262.
4. Provide valves with hand wheels that open by counterclockwise rotation of the valve stem.
5. Stuffing boxes shall be provided with O-ring stem seals and shall be bolted and constructed to permit easy removal of parts for repair.

**F. Check Valves for PVC:**

**NOTE: Check valves in a domestic plumbing system intended to convey water for human consumption shall comply with quality assurance, article 1.03C of this specification.**

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**SITE WATER DISTRIBUTION SYSTEMS**

1. Valves shall be swing-check type conforming to AWWA C508 or UL 312.
2. Valves shall be provided with cast iron or steel body and cover, flanged ends and clear port opening.
3. Valves shall be designed for a working pressure of 175 psi.

**G. Fire Hydrants:**

1. Before procurement, verify approval issued by the County of San Bernardino or Fire Department having jurisdiction.
2. Hydrants shall be wet barrel types conforming to AWWA C503 or UL 246.
3. Only 1¾ inch pentagonal nuts are to be provided on stems and protective caps.
4. Specified hydrants:
  - a. Clow/Rich # 850 or 860
  - b. James Jones #J3700 Fluted Barrel
  - c. LB Ironworks #702 Lido or 425

**H. Valve Boxes:**

1. 14-3/4"x20"x12" cast concrete with cast iron, traffic grade cover marked "WATER" (for use over water valves).
2. Brooks 36-H MB w/ No. 36-T cast iron cover EISEL363.5.

**I. Mechanical Thrust Restraint:**

1. Restraint shall be incorporated into the follower gland.
2. Restraint shall consist of individually actuated wedges that increase resistance to pull out as internal pressure or external forces increase.
3. Gland shall be ductile iron conforming to ASTM A 536.
4. Provide twist off nuts and tee-head bolts of the same size to ensure proper actuating of restraint devices.
5. Restraining device shall be provided with pressure rating equal to that of the pipe on which it is installed.
6. Restraining gland shall be UL listed.
7. Mechanical thrust restraint devices shall be EBAA Iron "Megalug", or equal.

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**J. Restraint Device Adapters:**

1. Restrained flange adapters shall be provided instead of threaded or welded flange spool pieces on plain end of ductile iron or PVC pipe.
2. Flange adapters shall be manufactured of ductile iron conforming to ASTM A 536 and be provided with flange bolt circles compatible with ANSI/AWWA C115/A21.15.
3. Restraint of flange adapter shall consist of a multiple number of individually actuated gripping wedges to maximize restraint capability.
4. Torque limiting actuating screws shall be provided to insure proper initial set of gripping wedges.
5. Flange adapter shall be capable of deflection during assembly or permit lengths of pipe to be field cut to allow at least 0.6 inch of gap between end of pipe and mating flange without affecting integrity of seal.
6. Flange adapter shall be provided with a safety factor of at least 2:1 for rated pressure.
7. Restraint device adapters shall be EBAA Iron "Megaflange", or equal.

**K. Tracer Wire for Nonmetallic Pipes:**

1. Tracer wires shall be electrically continuous #14 copper tracer wire, Type TW, blue plastic covered for domestic water and red for fire sprinkler. (Aluminum wire is prohibited). Provide in sufficient length to be continuous over each installed section of nonmetallic pipe.

**L. Pipe markers shall be a concrete plaque inscribed with the word "WATER."**

**M. Water Service Line Materials:**

1. Copper Tubing: Copper tubing shall conform to ASTM B 88, Type L.
2. Fittings for Copper Tubing: Fittings for solder-type joints shall conform to ANSI B16.18 or ASME/ANSI B16.22. Fittings for compression-type joints shall conform to ASME/ANSI B16.26, flared tube type.
3. Water Service Line Appurtenances:
  - a. Corporation stops shall be ground key type; manufactured of bronze conforming to ASTM B 61 or ASTM B 62; and suitable for the working pressure of the system. Ends shall be suitable for solder- joint or flared tube compression type joint connection. Threaded ends for inlet and outlet of corporation stops shall conform to AWWA C800; coupling nut for connection to flared copper tubing and shall conform to ASME/ANSI B16.26.

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- b. Goosenecks shall be type K copper tubing. Joint ends for goosenecks shall be as required for connecting to corporation stop and service line. Where multiple gooseneck connections are required for individual service, connect goosenecks to service line through brass or bronze branch connection; the total clear area of branches shall be at least equal to clear area of service line. Length of goosenecks shall be as indicated or required.
    - c. Curb or service stops shall be ground key, round way, inverted key type; bronze, conforming to ASTM B 61 or ASTM B 62; and rated at 150 psi. Ends shall be as required for connection to service piping. Arrow shall be cast into body of curb or service stop indicating direction of flow.
  - 4. Gate valves 2.5 inches and larger shall be MSS SP-80, Class 150, solid wedge, or resilient wedge gate, and non-rising stem. Valves shall be provided with flanged end connections. Provide hand wheel operators if easily accessible. Provide operating nut if inside a vault, pit or valve box.
  - 5. Gate valves in valve pits 2 inches, and smaller shall be MSS SP-80, Class 150, bronze, solid wedge, inside screw, rising stem. Valves shall be provided with flanged end connections or threaded end connections with union on one side of valve and hand wheel operator.
  - 6. Valve boxes shall be provided at each gate valve installed underground. Valve boxes shall be a size suitable for valve on which it is installed.
- N. Water meter indicated on Drawings will be installed by water purveyor for the area, unless noted otherwise.
- O. Strainers:
- 1. STR-1 Description: Wye type with monel or stainless steel strainer cylinder (manufacturer's standard mesh), and gasketed machine strainer cap. Where indicated on Drawings, provide with valved (globe valve) blow out piping, same size as blow out plug:
    - 2" and smaller: C.M. Bailey #100-A, bronze, 250 lb., or ductile iron with fusion bonded epoxy coating.
    - 2 1/2" and larger: Watts 77F-DI-FDA-125 lb., or other ductile iron fusion bonded epoxy coated flanged strainer, conforming to ASTM A-312 for the strainer body, and ASTM A-240 for the stainless steel strainer element. (No iron body strainer shall be used on potable water that is not fusion bonded epoxy coated inside and out.)

C.M.BAILEY      ARMSTRONG   WILKINS      WATTS
  - 2. STR-2 "Y" pattern, cast iron bodies, 125 psi, monel screen 16 sq. mesh. Open area at least twice the cross-sectional area of IPS pipe in which



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strainer is installed and may be woven wire or perforated type. Screwed ends for sizes up to 2", flanged ends for 2 1/2" and larger perforations, in accordance with the following:

BAILEY #100      ARMSTRONG   RP & CKECKLEY

3.     STR-3   Bucket type, flange, semi-steel body, 125 psi, stainless steel screen   with 1/8" diameter perforations (mounted above grade for water service). All sizes, (for mains serving fire sprinkler risers):

BAILEY #1            ZURN 150 Series      RP 7 C            WATTS 97FB-FSFE

STR-42" and larger: Watts 077-F-SS Stainless steel flange type strainer, or equal conforming to ASTM A-312 for strainer body, ASTM A-240 for the SS strainer element and ASTM A-36 for base flange material.

### **P. Backflow Preventer Assemblies:**

1.     Assembly shall be provided with flanged connections, ductile iron with fusion bonded epoxy coated construction, bronze, or stainless steel.
2.     Backflow preventer shall be suitable for cold water working pressure of 175 psi.
3.     Internal parts shall be designed for replacement without removing valves from line.
4.     Double check backflow preventer assembly shall consist of two independently acting spring cam or poppet style check valves, 2 shut-off valves and 4 test cocks. Check valve shall be designed to provide drip tight closure against reverse flow, low pressure drop at maximum flow capacity. Spring-loaded checks shall cause valve to seal against a higher inlet pressure than outlet pressure when there is no flow.
5.     Double check backflow preventer assembly shall meet AWWA Standard C510-89.  
Assembly shall be:  
Ames 2000ss Febco 850            Watts 709            Wilkins 350, or equal.
6.     Reduced pressure backflow preventer assembly shall consist of two check valves located between two shut-off valves with an area of reduced pressure between two check valves and a relief device arranged to discharge to atmosphere.
  - a.     Comply with AWWA Standard C511.
  - b.     Fluctuation in piping pressure shall not cause cycling. Backflow preventer shall automatically maintain low pressure zone to positively prevent backflow of water into system. Assembly shall automatically indicate failure of any part vital to backflow prevention by the continuous discharge relief device.

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- c. Reduced pressure backflow preventer assembly shall be Cla-Val Model RP-4, or equal.
- 7. Backflow prevention assemblies (devices), shall be tested and certified by a certified backflow tester, and a test report shall be provided to the water agency having jurisdiction. Testing shall be performed in the presence of the PI.

**PART 3 - EXECUTION**

**3.1 EXCAVATION, BACKFILLING AND COMPACTING**

- A. Conform to requirements in Section 02318: Excavation, Backfilling and Compacting for Utilities or Section 02315: Excavating, Back-Filling and Compacting.

**3.2 PIPE INSTALLATION**

- A. Project site water lines shall terminate approximately 5 feet from buildings, unless otherwise indicated on Drawings. Temporarily cap or plug terminals for future connection to building.

**3.3 CLEARANCES OF WATER LINE**

- A. Building or Structures: 2 feet.
- B. Parallel to Sewer Line:
  - 1. Water line 4 inches or less in diameter shall not be installed in a common trench with the building sanitary drain unless the bottom of the water line is at least 12 inches above the top of the building sanitary drain or where the water line is installed on a solid shelf excavated on one side of the common trench with a minimum clear horizontal distance of 12 inches from the building sanitary drain.
  - 2. Water mains 6 inches and larger in diameter shall be separated from the Project site sanitary sewer, receiving more than one building sanitary drain or acid pipeline, in accordance with the requirement of the State of California, Human and Welfare Agency, Department of Health Services.
- C. Crossing Sewer Line:
  - 1. A water main shall be separated from sanitary sewer in accordance with the requirements of the State of California Administrative Code, Title 22, Section 64630(e)(2), unless modified herein.
  - 2. Install water main a minimum of 12 inches clear, above or below a sanitary sewer.

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3. A water main 6 inches or greater in diameter, crossing under a Project site sanitary sewer line, shall be installed with all their joints located at least 10 feet away from each side of the sanitary sewer line.
  4. A water main 6 inches or greater in diameter, crossing over a Project site sanitary sewer line, shall be installed with all their joints located at least 4 feet away from each side of a purple pipe or sanitary sewer line.
- D. Install all water mains no closer than 10 feet horizontally clear from the edge of sewage leach fields, seepage pits, and septic tanks.

**3.4 PIPE INSTALLATION AND JOINING**

- A. Remove fins and burrs from pipe and fittings.
- B. Clean piping, fitting, valves, and accessories before installing. Maintain items in a clean condition.
- C. Provide proper facilities for lowering sections of pipe into trenches. Do not drop into piping, fittings, or other materials into trenches. Accurately cut pipe and install without springing or forcing. Replace any piping or fitting that does not provide sufficient space for proper installation of joining material.
- D. Blocking or wedging between bells and spigots is not permitted. Install bell and spigot pipe with bell end pointing in the direction of flow.
- E. Install piping to the lines and grades indicated or required. Low points and dips are not permitted. Support piping at proper elevation and grade with secure and uniform supports. Wood support blocking is not permitted. Where sand cement slurry will not be furnished for backfill, install piping so that full length of each section of pipe and each fitting will solidly rest on pipe bedding. Excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated or required for installation. Provide proper allowances and devices for expansion and contraction of piping and systems.
- F. Maintain trenches free of standing water until pipe joints have been installed.
- G. At the end of each day close open ends of pipe with temporary caps of the same material as the pipe.
- H. Do not install piping when trench or weather conditions prevent proper installation.

**3.5 INSTALLATION OF TRACER WIRE AND PIPE MARKERS**

- A. Tracer Wire: Install continuous length of tracer wire for full length of each run of nonmetallic pipe. Fasten wire to top of pipe in such a manner that it will not be displaced during construction operations. Wire shall be fastened to pipe at not greater than 20-foot intervals. Wire shall terminate above finished grade

## **SECTION 33 14 16 SITE WATER DISTRIBUTION SYSTEMS**

with a 12 inch lead taped around each riser. Provide a tracer wire to grade under a permanent marker where straight-line transitions of metallic to non-metallic pipe are installed.

- B. Underground Pipe Markers: Provide markers at grade where non-metallic pipe is installed and for each horizontal change in direction.

### **3.6 CONNECTIONS TO EXISTING WATER LINES**

- A. After PI has inspected installation, perform connections to servicing water lines. Schedule service shutdown for connecting new system at a time causing minimum disruption.
- B. Use a tap or drilling machine with valve and mechanical joint type sleeves for connections to waterlines under pressure, only if all other means of scheduling a shutdown time have been unsuccessful, and with the approval of the responsible engineer, and PI.
- C. Bolt sleeves around mains; bolt valve conforming to AWWA C500 to branch. Open valve, attach drilling machine, perform tap, close valve, and remove drilling machine, without interruption of service. Notify the PI in writing at least 5 days prior to the date of scheduled connections.

### **3.7 INSTALLATION OF PVC PLASTIC WATER MAINS**

- A. Unless otherwise indicated, install pipe and fittings as specified and in accordance with UBPPA UNI-B-3 and AWWA M23, Chapter 7, "Installation".
- B. Jointing:
  - 1. Provide push on joints with elastomeric gaskets specified for this type of joint, furnishing either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push on joint connections, provide pipe with push on joint ends furnished with factory installed bevel; for push on joint connections to metal fittings, valves and other accessories, square cut spigot end off pipe end.
  - 2. Provide push on joint lubricant recommended by manufacturer.
  - 3. Install push on joints for pipe-to-pipe connections in accordance with UBPPA UNI-B-3 and AWWA M23, Chapter 7, "Installation."
  - 4. Install push on joints for connection to fittings, valves, and other accessories in accordance with requirements of UBPPA Uni-B-3 and with applicable requirements of AWWA C600.
  - 5. Compression-type joints/mechanical-joints with gaskets, glands, bolts, nuts and internal stiffeners shall be installed in accordance with the requirements of UBPPA UNI-B-3 and AWWA C600 and Appendix A to AWWA C 111/A21.11.

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- a. Square cut spigot off end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel.
- 6. Sleeve-type mechanical couplings shall be provided in strict accordance with coupling manufacturer's recommendations using internal stiffeners as specified for compression-type joints.
- D. Provide mechanical thrust restraint devices for anchorage and piping unless thrust blocks are indicated on the Drawings. Thrust blocks shall be installed in accordance with the requirements of UBPPA UNI-B-3 except that size and location of blocks shall be as indicated. Thrust blocks shall be provided as specified in Section 02770: Site Concrete Work.

### **3.8 INSTALLATION OF VALVES**

- A. Provide gate valves conforming to AWWA C 500 and UL 262 in accordance with AWWA C600 for valve and fitting installation and with recommendations of AWWA C500 Appendix "Installation, Operation, and Maintenance of Gate Valves".
- B. Provide gate valves conforming to AWWA C 600 in accordance with AWWA C 509 for valve and fitting installation and with recommendations of AWWA C 500 Appendix "Installation, Operation, and Maintenance of Gate Valves".
- C. Provide gate valves on PVC water mains in accordance with AWWA M23 Chapter 7, "Installation."
- D. Provide check valves and fittings in accordance with applicable requirements of AWWA C600 unless noted otherwise on the Drawings.
- E. Provide gate and check valve joints as specified for the type of joints between pipe and fittings.

### **3.9 INSTALLATION OF HYDRANTS**

- A. Install hydrants according to requirements of AWWA C 600 for hydrant installation and as indicated. Provide joints as specified for the type of joints between pipe and fittings.
- B. Install hydrant with a 6-inch key gate valve between 4 and 10 feet from the hydrant.

### **3.10 INSTALLATION OF BACKFLOW PREVENTERS**

- A. Install Reduced pressure backflow preventers to comply with the Local Authority having jurisdiction.

### **3.11 WATER SERVICE LINE CONNECTION TO WATER MAINS**

- A. Connect service line to main by corporation stop and gooseneck. Install service stop as indicated on the Drawings. Connect service lines to PVC plastic water

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mains in accordance with UBPPA UNI-B8 and AWWA M23, Chapter 9, "Service Connections".

- B. Special Requirements for Plastic Piping: Unless otherwise indicated, install pipe and fittings in accordance with ASTM D 2774 and ASTM D 2855. Handle solvent cements for plastic pipe jointing in accordance with ASTM F 402. Install joints according to ASTM D 2855. Install other joints to materials other than pipe materials in accordance with plastic pipe manufacturer's recommendations.
- C. Connect plastic pipe service lines to corporation stops and gate valves according to plastic pipe manufacturer's recommendations.

### **3.12 INSTALLATION OF STRAINERS:**

- A. Strainers shall be installed on each water main downstream of the meter, above grade at the pressure regulating station. When a pressure regulating station (assembly) is not provided, "wye" type flange strainer shall be provided, with a shut off valve on the inlet and the outlet side.
- B. If the water main is serving fire sprinkler risers or hydrants, then an approved fire service strainer shall be used: Watts 97DB-FSFE or equal.

### **3.13 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM**

- A. When water piping has been installed and tested, sterilize system before use and/or Substantial Completion.
- B. Inject solution of liquid chlorine or sodium hypochlorite and water containing at least 50 PPM of free chlorine into a system in a manner to ensure that entire system is completely filled with solution. During this procedure operate valves and test outlets for residual chlorine. Continue injection until outlets indicate at least 59 PPM of free chlorine.
- C. After injection, isolate system and hold solution in retention for a period of at least 8 hours. Perform tests for residual chlorine after retention. If such tests indicate less than 50 PPM of residual chlorine, repeat entire procedure. After satisfactory sterilization has been verified, flush entire system until all traces of chlorine have been removed or until chlorine content is no greater than in existing water supply.

### **3.14 ELECTROLYSIS PREVENTION**

- A. A minimum 6 inch long brass nipple shall be installed at locations specified or as required. Flanges shall be provided with a complete insulating component consisting of; gasket bolt sleeves and bolt washers. Dielectric insulators shall be installed at locations indicated or as required. Dielectric fittings are prohibited.
- B. Where steel or cast iron below grade connects to copper or brass piping above grade, the transition from steel or cast iron pipe to copper or brass pipe shall be installed in an above grade accessible location.

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- C. Underground connections between dissimilar metals shall be in accessible yard boxes.
- D. Above ground dielectric connections shall be exposed.

**3.15 ABANDONING WATER LINES AND STRUCTURES**

- A. Water lines and all appurtenances to be abandoned in place shall be cut and removed from all areas where new Work is being installed.
- B. Cap or plug abandoned existing drain lines below grade in a yard box and according to UPC.

**3.16 TESTS AND INSPECTIONS**

- A. Provide labor, equipment, materials, test equipment and incidentals required for performing required field tests.
- B. Tests shall not be performed for 5 days after concrete thrust blocks have been installed.
- C. Testing Procedure: Water mains and service lines shall be tested in accordance with applicable specified standard.
  - 1. Test PVC plastic water system in accordance with UBPPA UNI-B-3 for pressure and leakage. The amount of leakage from PVC piping shall not exceed the amounts given in UBPPA UNI-B-3, except that no leakage is permitted for joints installed with sleeve type mechanical couplings.
  - 2. Test water service lines in accordance with applicable requirements of AWWA C 600. No leakage is permitted.
  - 3. Pressure testing: Before pressure test, fill portion of piping being tested with water for a minimum of 24 hours. Provide hydrostatic pressure of at least 50 psi greater than the maximum working pressure of tested system, but no less than 200 psi hydrostatic test pressure for system piping of 2 inches in diameter and larger. Provide and maintain hydrostatic test pressure for at least 2 hours to ensure no leakage of any portion of piping or appurtenances under pressure test.

**3.17 CLEANING**

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

**3.18 PROTECTION**

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

**SECTION 33 14 16  
SITE WATER DISTRIBUTION YSTEMS**

**END OF SECTION**



**SECTION 33 31 13**  
**SANITARY SEWAGE SYSTEM**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A.** Site sanitary drainage piping, fittings, and accessories.
- B.** Connection of building sanitary drainage system to site sanitary sewers.
- C.** Connection of site sanitary drainage system to municipal sewers.
- D.** Manhole access and cleanout access.
- E.** Extent of sanitary sewage systems work is indicated on drawings and schedules, and by requirements of this section.
- F.** Refer to Division-3 Sections for concrete work required for sanitary sewage systems; not work of this section.

**1.2 QUALITY ASSURANCE**

- A.** Manufacturer's Qualifications: Firms regularly engaged in manufacture of sanitary sewage system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B.** Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with sanitary sewage work similar to that required for project.
- C.** Codes and Standards:
  - (1)** Comply with UBC Chapter 9A (latest adopted addition).
  - (2)** Comply with the applicable portions of the UBC Chapter 33 (latest adopted addition).
  - (3)** Comply with the applicable portions of CBC including CCR, Title 24, Volume 2, Part 2, Chapter 33 (latest adopted addition).
  - (4)** Coordinate work of this Section with Permit provisions of the State of California Water Resources Control Board Order Number 92-08-DWQ.
  - (5)** The Owner's Storm Water Pollution Prevention Plan.
  - (6)** California Plumbing Code (latest adopted edition) CCR Title 24, Volume 3, Part 5.
  - (7)** Cal-OSHA.
  - (8)** OSHA.
  - (9)** ANSI A21.10
  - (10)** AWWA Publications regarding pipe and installation;

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- a. AWWA C 110.
  - b. AWWA C 111.
  - c. AWWA C 115.
  - d. AWWA C 151.
  - e. AWWA C 153.
  - f. AWWA C 214
  - g. AWWA C 503.
  - h. AWWA C 509.
  - i. AWWA C 511.
  - j. AWWA C 600.
  - k. AWWA C 651.
  - l. AWWA C 900.
  - m. AWWA C 901.
  - n. UNI - B - 3 with AWWA C 900.
- (11) American Society for Testing and Material publications;
- a. ASTM C12 - Practice for Installing Vitrified Clay Pipe Lines.
  - b. ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
  - c. ASTM C425 - Compression Joints for Vitrified Clay Pipe and Fittings.
  - d. ASTM C700 - Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.
  - e. ASTM D2321 - Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
  - f. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
  - g. ASTM D2774 - Recommended Practice for Underground Installation of Thermoplastic Pressure Piping.
  - h. ASTM D3034 - Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.
- (12) Sewer Purveyor Compliance: Comply with requirements of City of Fontana Public Works Department supplying sewer connections to project, obtain required permits and inspections.
- (13) Plumbing Code Compliance: Comply with applicable portions of National Standard Plumbing Code pertaining to selection and installation of storm sewage system's materials and products.
- (14) Environmental Compliance: Comply with applicable portions of local Environmental Agency regulations pertaining to storm sewage systems.

**1.3 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data and installation instructions for sewage system materials and products.
- B. Record Drawings: At project close-out, submit record drawings of installed sanitary sewage piping and products, in accordance with requirements of Division 1.
- C. Maintenance Data: Submit maintenance data and parts lists for sanitary sewage system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual.

**PRODUCTS**

**SECTION 33 31 13**  
**SANITARY SEWAGE SYSTEM**

**2.1 IDENTIFICATION**

- A.** Underground-Type Plastic Line Markers: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; metallic-lined, not less than 6" wide x 4 mils thick. Provide green tape with black printing reading "CAUTION - SEWER LINE BURIED BELOW".
  - (1)** Available Manufacturers: Subject to compliance with requirements, manufacturers offering identification markers which may be incorporated in the work include, but are not limited to, the following:
  - (2)** Manufacturer: Subject to compliance with requirements, provide identification markers of one of the following:
    - a.** Terra Tape Sentry Line 1350
    - b.** Allen Systems, Inc.
    - c.** Emed Co., Inc.
    - d.** Seton Name Plate Corp.

**2.2 PIPES AND PIPE FITTINGS**

- A.** General: Provide pipes of one of the following materials, of weight/class indicated on civil engineers plans. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated.
- B.** Vitrified Clay Pipe: ASTM C 700, bell and spigot ends, standard strength unless otherwise indicated.
  - (1)** Fittings: Vitrified clay bell and spigot, same strength as adjoining pipe, compression joints complying with ASTM C425.
- C.** Polyvinyl Chloride (PVC) Sewer Pipe: ASTM D 3033, Type PSP, SDR 35; or ASTM D 3034, Type PSM, SDR 35.
  - (1)** Fittings: PVC, ASTM D 3033 OR ASTM D 3034, solvent-cement joints complying with ASTM D 2855 using solvent cement complying with ASTM D 2564; or elastomeric joints complying with ASTM D 3212 using elastomeric seals complying with ASTM F477.
- D.** Polyvinyl Chloride (PVC) DWV Pipe: Schedule 80, ASTM D 2665.
  - (1)** Fittings: PVC Schedule 80, ASTM D 2665; solvent-cement joints, ASTM D 2664; or threaded joints.

**2.3 SANITARY SEWER MANHOLE**

- A.** General: Provide pre-cast reinforced concrete sanitary manholes as indicated, and complying with ASTM C 478.
- B.** Top: Pre-cast concrete, of concentric cone, eccentric cone, or flat slab top type, as indicated.
- C.** Base: Pre-cast concrete, with base riser section and separate base slab, or base riser section with integral floor, as indicated.

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- D.** Steps: Ductile-iron or aluminum, integrally cast into manhole sidewalls.
- E.** Frame and Cover: Ductile-iron, 26" diameter cover, heavy-duty, indented top design, with lettering cast into top reading "SANITARY SEWER".
- F.** Pipe Connectors: Resilient, complying with ASTM C 923.

**2.4 CLEANOUTS**

- A.** General: Provide as indicated, pipe extension to grade with ferrule and countersunk cleanout plug. Provide round cast-iron access frame over cleanout, with heavy-duty secured cover with lifting device.

**PART 3 EXECUTION**

**3 EXAMINATION**

- A.** Verify that trench cut is ready to receive work, and excavations, dimensions, and elevations are as indicated on Drawings.
- B.** Beginning of installation means acceptance of existing conditions.

**4 PREPARATION**

- A.** Hand trim excavations to required elevations. Correct over excavation with fill material or sand.
- B.** Remove large stones or other hard matter, which could damage drainage pipe or impede consistent backfilling or compaction.
- C.** Install bedding as specified in Section 02317.

**5 INSTALLATION OF IDENTIFICATION**

- A.** General: During back-filling/top-soiling of storm drainage systems, install continuous metallic lined underground warning tape, located directly over buried line at 6" to 8" below finished grade. Tape shall be polyethylene with metallic core, 6 inches wide by 4 mils thick, solid green color with continuously printed caption in black letters "CAUTION - SEWER LINE BURIED BELOW."

**6 INSTALLATION OF PIPE AND PIPE FITTINGS**

- A.** General: Install piping in accordance with Section 306, of the Standard Specifications for Public Works Construction. Seal joints water tight.
- B.** Surveyor Qualifications
  - (1)** Surveyor shall currently be licensed in the State of California as a Professional Land Surveyor.
  - (2)** Surveyor shall employ proper field procedures, instrumentation and adequate survey personnel in order to achieve accuracies as required by each section.
  - (3)** Cut sheets, if required, shall be provide to the Inspector of Record.
- C.** Sanitary Sewer Staking:

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- (1)** Stakes shall be located with positional accuracies of a minimum of 0.04 feet horizontally and 0.01 feet vertically.
  - (2)** One set of construction stakes with lath shall be set. Lath shall indicate offset, cut/fill, and reference point.
  - (3)** Stakes shall be provided for sewer lines at a maximum interval of 25 feet, grade breaks, angle points, manholes, cleanouts, clarifiers and building points of connection.
  - (4)** Construction stakes shall be offset to the side of the utility at a distance from centerline designated by contractor and agreed to by surveyor prior to commencement of staking.
  - (5)** Surveyor shall provide to the Project Inspector cut sheets for all staking. The contractor shall not commence work until the Project Inspector has been provided copies of said cutsheets.
  - (6)** All stakes shall be preserved in place until such time that the Project Inspector has approved utility installation for backfilling.
  - (7)** All utilities to be installed at slopes less than 0.01 feet per foot shall be certified by the construction surveyor. Written certification shall be provided to the Project Inspector and the Owner Authorized Representative (OAR).
  - (8)** Should a dispute arise over the position of the utility in question and the stakes provided for said installation are removed, destroyed, or disturbed, the contractor assumes full responsibility for all cost associated with the resolution of the dispute.
- D.** Inspect piping before installation to detect apparent defects. Mark defective materials with white paint and promptly remove from site.
- E.** Lay piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert.
- F.** Place bell ends or groove ends of piping facing upstream.
- G.** Install gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements.
- H.** Plastic Pipe: Install in accordance with manufacturer's installation recommendations, and in accordance with ASTM D 2321.
- I.** Cleaning Piping: Clear interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed.
- (1)** In large, accessible piping, brushes and brooms may be used for cleaning.
  - (2)** Place plugs in ends of uncompleted pipe at end of day or whenever work stops.
  - (3)** Flush lines between manholes if required to remove collected debris.

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- J.** Joint Adaptors: Make joints between different types of pipe with standard manufactured adaptors and fittings intended for that purpose.
- K.** Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.
- L.** Make inspections after lines between manholes, or manhole locations, have been installed and approximately 2' of backfill is in place, and again at completion of project.
  - (1)** If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, correct such defects, and re-inspect.
- M.** Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods for size and type material being closed. Wood plugs are not acceptable.

**7      SANITARY MANHOLES AND CLEANOUTS**

- A.** General: Place pre-cast concrete sections as indicated. Where manholes and cleanouts occur in pavements, set tops of frames and covers flush with finish surface. Elsewhere, set tops 2" above finish surface, unless otherwise indicated.
- B.** Spacing of manhole and cleanouts shall be a minimum as indicated by the Uniform Plumbing Code.
- C.** Form bottom of excavation clean and smooth to correct elevation.
- D.** Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections
- E.** Install in accordance with ASTM C 891.
- F.** Provide rubber joint gasket complying with ASTM C 443 at joints of sections.
- G.** Apply bituminous mastic coating at joints of sections.
- H.** Establish elevations and pipe inverted for inlets and outlets as indicated.
- I.** Mount lid and frame level in grout, secured to top cone section to elevation indicated.

**8      TAP CONNECTIONS**

- A.** Make connections to existing piping and underground structures, so that finished work will conform as nearly as practicable to requirements specified for new work.
- B.** Use commercially manufactured wyes for branch connections. Field cutting into piping will not be permitted. Spring wyes into existing line and encase entire wye, plus 6" overlap, with not less than 6" of 3,000-psi 28-day compressive strength concrete.
- C.** Branch connections made from side into existing 4" to 21" piping shall have wye sprung into existing line, and entire wye encased with not less than 6" of 3,000 psi 28-day compressive strength concrete.

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- D.** Take care while making tap connections to prevent concrete or debris from entering existing piping or structure. Remove debris, concrete, or other extraneous material, which may accumulate.
- E.** Contractor shall be responsible for all coordination with the City of Fontana Public Works Department connections to be made to City mains.

**9 BACKFILLING**

- A.** General: Conduct backfill operations of open-cut trenches closely following laying, jointing, and bedding of pipe, and after initial inspection and testing are completed.
- B.** Request inspections by project Geotechnical Laboratory during all backfill operations.
- C.** To minimize local area traffic interruptions, allow no more than 100' between pipe laying and point of complete backfilling.
- D.** Place pipe on bedding as specified in Section 02317.
- 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.

**10 FIELD QUALITY CONTROL**

- A.** Testing: Perform pressure testing of completed piping in accordance with the provisions of the project specifications prior to backfilling.
- B.** Video Inspection: The prime plumbing contractor shall submit to the Architect within 35 days after the start of construction, the name of an independent sub-contractor that will provide the inspection by video recording on digital video disk (DVD) the installed sanitary sewage system. The inspection and video recording shall commence only after all underground utilities have been installed, and all excavation has occurred. The inspection and video recording shall commence only after all pipes have been flushed with clean water so that any presence of ponding shall be easily identified. The District shall be notified at least 24 hours prior to the video inspection to give the District Maintenance personnel the option of attending the inspection/video recording. The sub-contractor providing the video inspection shall provide the construction manager/prime plumbing contractor and owner one copy each of the DVD.
- C.** A written narrative shall accompany the DVD with documentation of any irregularities encountered, such as debris in the lines, broken lines, lines that indicate negative slopes by the presence of ponding, lines not installed per the project specifications, and verification of cleanouts and pipe routing for compliance with the approved civil engineers plans.
- D.** The video recording and written narrative shall be provided to the District at the expense of the contractor.
- E.** The contractor shall correct any and all irregularities identified by video detection at no cost to the District. The prime plumbing contractor shall conduct a new video inspection of those lines repaired, replaced, or realigned at no cost to the District.

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**11 TESTING**

- A.** After installation, test each sanitary drain and/or sewer and each section between successive manholes, for either infiltration or exfiltration. Test shall be conducted in accordance with Section 306-Underground conduit Construction of the Standard Specifications for Public Works Construction.
- B.** Where excessive ground water is encountered test the pipeline for infiltration.
- C.** When infiltration or exfiltration exceeds allowable amounts as set forth in the Section 306 formula, perform repairs or replacements as necessary to comply with the required limits.

**12 PROTECTION**

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

**12.2 CLEANUP**

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

**END OF SECTION**



**SECTION 33 40 00 - 1**  
**STORM DRAINAGE SYSTEM**

**PART 1 - GENERAL**

**1 SUMMARY**

- A. Provisions of Division 01 apply to this section.
- B. Section Includes:
  - 1. Catch basins, grates and frames; culverts; curb inlets; drainage pipes; sub-surface drains; manhole covers and frames; surface run-off collection or infiltration.
- C. Definitions:
  - 1. BMP: Stormwater Best Management Practice.
  - 2. Post Construction BMP's: Devices installed by the Contractor for storm water management to be left on site after construction completion.
  - 3. SWPPP: Storm Water Pollution Prevention Plan.

**1.2 SUBMITTALS**

- A. Shop Drawings: Submit site plan denoting locations of lines, valves, and appurtenances.
- B. Product Data: Manufacturer's catalog data for all required materials. Include technical data for accessories, information concerning gaskets, joints and couplings.
- C. Certificates: Certificates attesting that tests set forth in referenced publication have been performed and the results required by design have been met.
- D. Closeout Documents: Submit the following documents to the OAR at Substantial Completion:
  - 1. Maintenance Log: Maintenance and upkeep records of the installed Post Construction BMP's. Provide in electronic MS Excel Sheet including the following headers as a minimum: "Date of Service", "Location of BMP", "Type of Maintenance or Service", "Notes", "Next Scheduled Preventive Maintenance Due", and "Inspector Signature".
  - 2. Two copies of the latest project SWPPP including Notice of Termination (NOT) from the State Water Board.

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3. Record drawings: As-Built site plan(s) showing the Post Construction BMP's. Provide a copy of marked record set with red pencil identifying any variations from design documents at substantial completion.
4. Two CD's containing electronic MS Excel Sheet including the following headers as a minimum: "BMP Description", "Location of BMP and Map Grid Location" and "Type of Maintenance or Service Needed", i.e.; weekly, monthly, quarterly, etc. "Stock No.", "Manufacturer Contact Information", along with "Frequency" i.e.; weekly, monthly, quarterly, etc. and "Special Instructions".
5. Maintenance Manuals: Provide Maintenance Manual for specific storm drainage BMP components installed along with requirements, replacement or maintenance schedule and plans with the location of each BMP component. This manual shall include product information cut sheet, shop drawings, vendor information for each component and warranty.

**1.3 QUALITY ASSURANCE**

- A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction, current edition.

**1.4 TRAINING OF OWNER PERSONNEL**

- A. At Substantial Completion and when the storm drainage system is fully operational, knowledgeable representatives from the contractor and manufacturer(s) of various components specified and installed at the site shall provide up to 8 hours of training. Date, time and location for the training shall be coordinated through the project OAR.
- B. Training period shall cover but not be limited to the following:
  1. Explain the operation of storm drainage system and its design intent.
  2. Explain the maintenance requirements of every component of the system.
  3. Provide recommendations of practices to minimize or eliminate negative impact on the system.
  4. Provide maintenance schedule as recommended by the manufacturers for every component and review it with M & O staff.
  5. Conduct a site walk, identify every component of the system and demonstrate its operation.

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6. Training shall be conducted with the use of Maintenance log and Maintenance manual.
- C. Provide the following training documentations:
  1. Have all District attendees sign off training sheet and provide a copy to the OAR.
  2. Provide Operations and Maintenance manuals at the time of training to the Districts staff. The manual shall include only the components that are installed at the site.
  3. Upon completion of training, provide a DVD of materials covered in the training and components installed.

**1.5 SURPLUS MATERIALS**

- A. Provide sufficient additional materials for each component of BMP that requires replacement or service during the first year.

**PART 2 – PRODUCTS**

**2.1 MATERIALS**

- A. Storm Drain Pipe: Provide in conformance with Section 207 - Pipes and Section 208 - Pipe Joint Types and Materials of the Standard Specifications for Public Works Construction.
- B. Perforated Subsurface Drain Pipe: Provide shop-perforated with perforations symmetrically located within a maximum arc of 160 degrees. Perforations shall provide a total open area of at least 0.3 square inches per linear foot of pipe, with a minimum of one perforation per linear foot, except for joint areas. Perforation shall be either holes or slots. Hole diameters of 1/4 inch minimum to 3/8 inch maximum. Width of slots of 3/16 inch minimum to 5/16 inch maximum with slot length not exceeding 4 inches.
- C. Concrete, Mortar and Related Materials: Conform to Section 02770: Site Concrete Work.
- D. Metal Covers, Grates, Frames and Accessories:
  1. Conform to Section 206 - Miscellaneous Metal Items of the Standard Specifications for Public Works Construction.
  2. Hot-dip galvanize steel parts after fabrication and before installation, in accordance with Section 210 - Paint and Protective Coating of the Standard Specifications for Public Works Construction.

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- 3. Grates and Frames: Vandal-proof design and construction.
- E. Filter Material for Subsurface Drain: Non-woven geotextile filter fabric, Mirafi 140N, or equal.
- F. Aggregate Around Perforated Pipe: 6 inches of gravel containing no particles finer than a 3/8 inch to 1/2 inch sieve opening size.
- G. Manhole Brick Mortar, Grout, and Plaster: Conform to Standard Specifications for Public Works Construction, Section 202 - Masonry Materials.

**PART 3 – EXECUTION**

**3.1 EXCAVATION, BACKFILLING AND COMPACTING**

- A. Conform to the requirements of Section 02315: Excavating, Backfilling and Compacting or Section 02318: Excavating, Backfilling and Compacting for Utilities, as required.

**3.2 INSTALLATION OF PIPE**

- A. Conform to Section 306 - Underground Conduit Construction of the Standard Specifications for Public Works Construction.
- B. Non-ferrous drainpipe installed with less than 12 inches of cover to finish grade shall be provided with a 4 inch thick concrete pipe encasement.

**3.3 DRAINAGE APPURTENANCES**

- A. Catch basins, junction chambers, manholes, box culverts, outlet chambers and other drainage structures: Construct as indicated on Drawings and as specified in Section 02770: Site Concrete Work.
- B. Ensure that all Post Construction BMP have a visible identifying manufacturer tag with product identification, manufacturer contact information, date of last service and date of next service due.
- C. Provide storm drain stencil per City or County requirements as applicable.

**3.4 ABANDONED DRAINAGE LINES AND STRUCTURES**

- A. Cap or plug existing drain lines that are cut and abandoned and remove existing drainage structures that are abandoned.

**3.5 CLEANUP**

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.
- B. Maintain Post Construction BMP's after installation and keep a

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maintenance log to be turned over to OAR at Substantial Completion.

**3.6 PROTECTION**

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

**END OF  
SECTION**