

# MERLO STATION HIGH SCHOOL

## CTE PROGRAM REMODEL & TENANT IMPROVEMENT

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### TECHNICAL SPECIFICATIONS



Bidding Document Submission  
December 5, 2019

CIDA PROJECT NUMBER: 190037.01



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**STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR**

AIA Document A101, 2007 Edition  
Incorporated by Reference Only

**GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION**

AIA Document A201, 2007 Edition  
Incorporated by Reference Only

**HAZARDOUS MATERIAL INVESTIGATION AND REPORT**

Incorporated by Reference Only – Available from BSD  
Report denotes no known asbestos materials in area of work.

**DIVISION 1 GENERAL CONDITIONS**

010800	Supplementary Conditions
011000	Summary
012100	Allowances
012200	Unit Prices
012500	Substitution Procedures
	Substitution Request Form: CSI Form 1.5C
012600	Contract Modification Procedures
012900	Payment Procedures
013100	Project Management and Coordination
013123	Project Management Database (e-Builder)
013200	Construction Progress Documentation
013300	Submittal Procedures
013553	Security Procedures
014000	Quality Requirements
014200	References
015000	Temporary Facilities and Controls
016000	Common Product Requirements
017300	Execution
017329	Cutting and Patching
017700	Closeout Procedures
017823	Operation and Maintenance Data
017839	Project Record Documents
017900	Demonstration and Training
019113	General Commissioning Requirements

**DIVISION 2 EXISTING CONDITIONS**

024119	Selective Structure Demolition
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**DIVISION 3 CONCRETE**

033000	Cast-In-Place Concrete
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**DIVISION 5 METALS**

055213 Pipe And Tube Railings

**DIVISION 6 WOOD, PLASTICS, AND COMPOSITES**

061053 Miscellaneous Rough Carpentry  
064023 Interior Architectural Woodwork

**DIVISION 7 THERMAL AND MOISTURE PROTECTION**

072100 Thermal Insulation  
079200 Joint Sealants

**DIVISION 8 OPENINGS**

081113 Hollow Metal Doors And Frames  
083613 Sectional Doors  
087100 Door Hardware

**DIVISION 9 FINISHES**

092216 Non-Structural Metal Framing  
092900 Gypsum Board  
095113 Acoustical Panel Ceilings  
096513 Resilient Base And Accessories  
099123 Interior Painting

**DIVISION 10 SPECIALTIES**

101100 Visual Display Surfaces  
101400 Signage  
102600 Wall And Door Protection  
104413 Fire Extinguisher Cabinets  
104416 Fire Extinguishers  
105113 Metal Lockers

**DIVISION 13 SPECIAL CONSTRUCTION**

133419 Metal Building Systems

**DIVISION 21 FIRE SUPPRESSION**

210000 General Mechanical Provisions  
210500 Basic Materials and Methods  
210510 Pipe and Pipe Fittings  
210523 Valves  
210529 Supports and Anchors  
211300 Fire Sprinkler Systems

**DIVISION 22 PLUMBING**

220000	General Provisions
220300	Plumbing
220500	Basic Materials and Methods
220510	Pipe and Pipe Fittings
220523	Valves
220529	Supports and Anchors
220700	Mechanical Insulation

### **DIVISION 23 HEATING, VENTILATING, AND AIR CONDITIONING**

230000	General Provisions
230500	Basic Materials and Methods
230529	Supports and Anchors
230594	Testing, Adjusting, and Balancing
230700	Mechanical Insulation
233300	Air Distribution
233450	Dust Collector

### **DIVISION 26 ELECTRICAL**

260000	Electrical General Requirements
260519	Low-Voltage Electrical Power Conductors and Cables
260526	Grounding and Bonding for Electrical Systems
260529	Hangers and Supports for Electrical Systems
260533	Raceway and Boxes for Electrical Systems
260553	Identification for Electrical Systems
262726	Wiring Devices
262800	Low-Voltage Circuit Protective Devices
265000	Lighting

### **DIVISION 27 COMMUNICATIONS**

270528	Pathways for Communications Systems
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### **DIVISION 28 ELECTRONIC SAFETY AND SECURITY**

280500	Common Work Results for Electronic Safety and Security
281300	Access Control
284600	Fire Detection and Alarm

### **DIVISION 31 EARTHWORK**

312000	Earth Moving
312333	Trenching and Backfill
312500	Erosion and Sediment Control

### **DIVISION 32 EXTERIOR IMPROVEMENTS**

321200	Flexible Paving
321600	Concrete Curbs Gutters and Walks
323113	Chain Link Fences and Gates

### **DIVISION 33 UTILITIES**

334000 Storm Drainage Utilities

## PART 1 – GENERAL

## 1.1 STATUS OF GENERAL CONDITIONS

## A. Supplements:

1. Supplements in this Document modify, change, delete from and add to the general conditions listed in *Standard Form of Agreement Between Owner and Contractor AIA Document A101-2017 Edition* and *General Conditions of the Contract for Construction AIA Document A201, 2017 Edition*.
2. Where any Article, Paragraph, subparagraph or clause of the above general conditions is modified or deleted by these supplements, the unaltered provisions of that Article, Paragraph, subparagraph or clause shall remain in effect.

## 1.2 MODIFICATIONS TO GENERAL CONDITIONS

## A. General Provisions:

1. Correlation and intent of the contract documents:
  - a. References in Contract Documents to building codes, industry standards, published specifications and manufacturer's instructions shall mean the current edition of the referenced document in effect on the date of the signed Owner-Contractor Agreement.
  - b. In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:
    1. Modifications.
    2. The Agreement.
    3. Addenda, with those of later date having precedence over those of earlier date.
    4. The Supplementary Conditions.
    6. Division 1 of the Specifications.
    7. Drawings and Divisions 2–49 of the Specifications.
    8. Other documents specifically enumerated in the Agreement as part of the Contract Documents.
  - c. In the case of conflicts or discrepancies between Drawings and Divisions 2–49 of the Specifications, or within or among the Contract Documents and not clarified by Addendum, the Architect will determine which takes precedence in accordance with the General Conditions of the Contract.
  - d. Immediately notify Architect/Engineer of any error, omission or discrepancy appearing on the Contract Documents. In the event of a conflict or discrepancy of the Contract Documents, the larger quantity and highest quality shall govern, unless the smaller quantity or lower quality is accepted by written clarification or modification is issued by the Architect/Engineer.

## 1.3 INTERPRETATION:

- A. Viewed or approved by Architect/Engineer shall mean written review or approval by Architect/Engineer or an authorized consultant.
- B. Terms used in the Specifications such as approved, accepted, directed, required, reviewed and selected shall be interpreted to mean as approved, accepted, directed, required, reviewed and selected the Architect/Engineer.
- C. Reference in the Specifications to a single item or piece of equipment shall apply to as many such items as are indicated on Drawings or required to complete the Project.
- D. Listing an item or method in the Specifications or indicating an item or method on the Drawings requires the Contractor to furnish, fabricate and install the item, unless indicated otherwise.

#### 1.4 FEES

- A. Unless otherwise indicated in the Contract Documents, the Owner shall pay for plan check fees and building permit fees, including sewer, gas and water connection fees, as well as other assessments or fees established by the authority having jurisdiction. The Contractor shall pay for all other permits, fees, licenses and inspections necessary for proper execution and completion of Work, including plumbing, mechanical and electrical permit fees.

END OF SECTION

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Coordination with occupants.
5. Work restrictions.
6. Specification and drawing conventions.

## B. Related Section:

1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

## 1.2 PROJECT INFORMATION

## A. Project Identification: Merlo Station High School – Career Technical Education (CTE) Program

1. Project Location: 1841 SW Merlo Rd. Beaverton, OR 97006

## B. Owner: Beaverton School District

## C. Owner's Representative: Beaverton School District – Facilities Development

1. Contact: Scott Johnson, Project Manager (503) 356-4552
2. Contact: Angela Knotts, Project Coordinator (503) 356-4576

## D. Owner's Commissioning Agent: GLUMAC

1. Contact: Jeremy Braithwaite (503) 227-5280

## E. Owner's Hazardous Material Surveyor: TRC

1. Contact: Ron Landolt (503) 387-3251

## F. Mechanical, Electrical and Plumbing Engineer: R&amp;W Engineering, Inc.

1. Contact: Ed Carlisle (503) 726-3322

## G. Architect and Structural Engineer: CIDA

1. Contact: Chris Walker, RA (503) 226-1285 X 308
2. Contact: Curtis Gagner, PE/SE (503) 226-1285 X 324

## H. General Contractor: TBD

1. Contact: TBD

### 1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of the Project is defined by the Contract Documents and consists of the following:
  - 1. Remodel of existing classroom and storeroom areas for new CTE program focused on commercial construction trade education. Exterior improvements include conversion of paved yard to program areas for covered welding, material storage and flat work areas.
- B. Type of Contract.
  - 1. Project will be constructed under a single prime contract.
    - a. *Standard Form of Agreement Between Owner and Construction Manager as Constructor AIA Document A133, 2009 Edition*
    - b. *General Conditions of the Contract for Construction AIA Document A201, 2007 Edition.*

### 1.4 ACCESS TO SITE

- A. General: Contractor shall have full use of Project Area for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

### 1.5 COORDINATION WITH OCCUPANTS

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

### 1.6 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.
  2. Comply with noise ordinances of the authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building and site as follows:
1. Weekdays: 6:00 a.m. to 5:00 p.m.
  2. Saturdays and Sundays: Arrange with Owner's Representative
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
1. Obtain Owner's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
1. Notify Owner not less than two days in advance of proposed disruptive operations.
  2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Controlled Substances: Use of tobacco products, vaping/e-cigarettes and other controlled substances on the Project site is not permitted.

#### 1.7 SPECIFICATION AND DRAWING CONVENTIONS

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
- B. Description: Contractor shall provide within his bid amount the allowances as described in the Schedule of Allowances at the end of this Section. The allowance has been established in lieu of additional requirements for that work, and further requirements for allowances will be issued by the Architect prior to work indicated by the allowance. A change order for the work will be written to compensate for the required work identified by each allowance.
- C. Cash Allowance: A monetary sum that is to be included as part of the contract sum to account for certain items to be determined at a later time.

### 1.2 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

### 1.3 COORDINATION

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

### 1.4 ALLOWANCES

- A. The cash allowance amounts listed below are to be added to the contract price as a line item that is not included within the Contractor's total contract amount and therefore do not have overhead, profit or insurance included. These items will be included within the Change Order if needed.
- B. Except as indicated above, comply with provisions of the General Conditions.
- C. The Architect and Owner's Representative will determine work that will be applied to the Allowances listed below. The Contractor shall price and perform work as additional work to the Contract. Requested work will be changed to the Contract by Change Order written against the Contract.
- D. A Change Order will be written to credit the Allowance amounts listed below. Overhead, profit and insurance will not be included within these change order amounts.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALLOWANCES

A. Allowance #1 – Dock Leveler Refurbishment

1. Provide allowance for review and repair of the existing dock leveler to remain. To include:
  - a. Electrical motor and controls
  - b. Mechanical systems
  - c. Physical features including hinges and mounting

B. Review additional possible allowances with the District

END OF SECTION

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Section:
  - 1. Division 01 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

### 1.2 DEFINITIONS

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

### 1.3 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. Schedule:
  - 1. A "Schedule of Unit Prices" is included at the end of this section.
  - 2. Include as part of each unit price, miscellaneous devices, appurtenances and similar items incidental to or required for a complete system whether or not mentioned as part of the unit price.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

END OF SECTION

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.

### 1.2 DEFINITIONS

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

### 1.3 SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Architect to forward any substitution to BSD representative for approval prior to acceptance by the Architect.
  - 1. Substitution Request Form: Use CSI Substitution Request Form 1.5C provided at the end of this section.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    - e. Samples, where applicable or requested.
    - f. Certificates and qualification data, where applicable or requested.
    - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
    - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
    - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided

within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.

- k. Cost information, including a proposal of change, if any, in the Contract Sum.
- l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
- m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

## PART 2 - PRODUCTS

### 2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 15 fifteen days prior to time required for preparation and review of related submittals.
  - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:
    - a. Requested substitution has been approved by the Owner.
    - b. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    - c. Requested substitution will not adversely affect Contractor's construction schedule.
    - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
    - e. Requested substitution is compatible with other portions of the Work.
    - f. Requested substitution has been coordinated with other portions of the Work.
    - g. Requested substitution provides specified warranty.
    - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed.

## PART 3 - EXECUTION (Not Used)

END OF SECTION



# SUBSTITUTION REQUEST (During the Bidding Phase)

Project: \_\_\_\_\_ Substitution Request Number: \_\_\_\_\_  
 \_\_\_\_\_  
 From: \_\_\_\_\_  
 To: \_\_\_\_\_ Date: \_\_\_\_\_  
 \_\_\_\_\_  
 Re: \_\_\_\_\_ A/E Project Number: \_\_\_\_\_  
 \_\_\_\_\_ Contract For: \_\_\_\_\_

Specification Title: \_\_\_\_\_ Description: \_\_\_\_\_  
 Section: \_\_\_\_\_ Page: \_\_\_\_\_ Article/Paragraph: \_\_\_\_\_

Proposed Substitution: \_\_\_\_\_  
 Manufacturer: \_\_\_\_\_ Address: \_\_\_\_\_ Phone: \_\_\_\_\_  
 Trade Name: \_\_\_\_\_ Model No.: \_\_\_\_\_

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

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: \_\_\_\_\_  
 Signed by: \_\_\_\_\_  
 Firm: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Telephone: \_\_\_\_\_

### A/E's REVIEW AND ACTION

- Substitution approved - Make submittals in accordance with Specification Section 01330.
- Substitution approved as noted - Make submittals in accordance with Specification Section 01330.
- Substitution rejected - Use specified materials.
- Substitution Request received too late - Use specified materials.

Signed by: \_\_\_\_\_ Date: \_\_\_\_\_

Supporting Data Attached:  Drawings  Product Data  Samples  Tests  Reports  \_\_\_\_\_

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

### 1.2 MINOR CHANGES IN THE WORK

- A. Architect or Consultant may issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

### 1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect or Consultant will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Proposal Requests issued by Architect/Consultant are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Proposal Request after receipt of Proposal Request, Contractor shall submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.
    - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  - 3. Proposal Request Log: Contractor shall maintain a current log of all proposed requests and submit same at each project meeting and with each application for payment. Each proposal request shall have a unique number for tracking purpose. The log shall, at a minimum, show the proposal request number, date initiated, brief description, reference (i.e. RFI or supplemental instruction), estimated cost, estimated time, status, and reason for the proposal request (i.e. Unforeseen Condition/ Regulatory Requirement/ Owner Request/ E&O).

#### 1.4 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: Refer to Division 01 Section "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit Price Adjustment: Refer to Division 01 Section "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit price work.

#### 1.5 CHANGE ORDER PROCEDURES

- A. On District's approval of a Proposal Request, Architect/Consultant will issue a Change Order for signatures of Owner and Contractor on form provided by the District.

#### 1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Upon request of the Owner's Representative Architect/Consultant may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

## 1.2 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
  - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
  - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
  - 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Distribute signed application including copy of waivers of lien and similar attachments to e-Builder.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
  - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  - 2. When an application shows completion of an item, submit conditional final or full waivers.
  - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  - 4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

- G. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
  2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- H. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
  2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  3. Updated final statement, accounting for final changes to the Contract Sum.
  4. AIA Document G706-1994, "Contractor's Affidavit of Payment of Debts and Claims."
  5. AIA Document G706A-1994, "Contractor's Affidavit of Release of Liens."
  6. AIA Document G707-1994, "Consent of Surety to Final Payment."
  7. Evidence that claims have been settled.
  8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
  9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. Coordination drawings.
  - 2. Requests for Information (RFIs).
  - 3. Project Web site.
  - 4. Project meetings.

### 1.2 DEFINITIONS

- A. RFI: Request from Owner, Architect, Consultant or Contractor seeking information from each other during construction.

### 1.3 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
  - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  - 1. Preparation of Contractor's construction schedule.
  - 2. Preparation of the schedule of values.
  - 3. Installation and removal of temporary facilities and controls.
  - 4. Delivery and processing of submittals.
  - 5. Progress meetings.

6. Preinstallation conferences.
7. Project Closeout Conference.
8. Startup and adjustment of systems.
9. Project closeout activities.

#### 1.4 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
  1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
    - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    - b. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
  1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing and electrical Work.
  2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.
  3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment.
  4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
  5. Review: Architect/Consultant will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility.

#### 1.5 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
  1. Architect/Consultant will return RFIs submitted to Architect/Consultant by other entities controlled by Contractor with no response.
  2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
  2. Project number.
  3. Date.
  4. Name of Contractor.
  5. Name of Architect.
  6. RFI number, numbered sequentially.
  7. RFI subject.
  8. Specification Section number and title and related paragraphs, as appropriate.
  9. Drawing number and detail references, as appropriate.
  10. Field dimensions and conditions, as appropriate.
  11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  12. Contractor's signature.
  13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to the District.
- D. Architect's Action: Architect/Consultant will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect/Consultant after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for coordination information already indicated in the Contract Documents.
    - d. Requests for adjustments in the Contract Time or the Contract Sum.
    - e. Requests for interpretation of Architect's actions on submittals.
    - f. Incomplete RFIs or inaccurately prepared RFIs.
  2. Architect's/Consultant's action may include a request for additional information, in which case the allotted time for response will date from time of receipt of additional information.
  3. Architect's/Consultant's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect/Consultant and Owner's Representative in writing within seven days of receipt of the RFI response.
- E. On receipt of Architect's/Consultant's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect/Consultant and Owner's Representative within seven days if Contractor disagrees with response.

- F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of Project Web site (e-Builder).

## 1.6 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
  - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner's Representative and Architect/Consultant of scheduled meeting dates and times.
  - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner's Representative and Architect/Consultant, within three days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
  - 1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Procedures for processing field decisions and Change Orders.
    - f. Procedures for RFIs.
    - g. Procedures for testing and inspecting.
    - h. Procedures for processing Applications for Payment.
    - i. Distribution of the Contract Documents.
    - j. Submittal procedures.
    - k. Sustainable design requirements.
    - l. Preparation of record documents.
    - m. Use of the premises and existing building.
    - n. Work restrictions.
    - o. Working hours.
    - p. Owner's occupancy requirements.
    - q. Responsibility for temporary facilities and controls.
    - r. Procedures for moisture and mold control.
    - s. Procedures for disruptions and shutdowns.
    - t. Construction waste management and recycling.
    - u. Parking availability.

- v. Office, work, and storage areas.
  - w. Equipment deliveries and priorities.
  - x. First aid.
  - y. Security.
  - z. Progress cleaning.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect/ Consultant and Owner's Representative of scheduled meeting dates.
  - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. Contract Documents.
    - b. Options.
    - c. Related RFIs.
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Submittals.
    - h. Review of mockups.
    - i. Possible conflicts.
    - j. Compatibility problems.
    - k. Time schedules.
    - l. Weather limitations.
    - m. Manufacturer's written recommendations.
    - n. Warranty requirements.
    - o. Compatibility of materials.
    - p. Acceptability of substrates.
    - q. Temporary facilities and controls.
    - r. Space and access limitations.
    - s. Regulations of authorities having jurisdiction.
    - t. Testing and inspecting requirements.
    - u. Installation procedures.
    - v. Coordination with other work.
    - w. Required performance results.
    - x. Protection of adjacent work.
    - y. Protection of construction and personnel.
  - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Conduct progress meetings at intervals indicated in Owner/Contractor Agreement.
1. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority and Architect/ Consultant, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Status of submittals.
      - 4) Deliveries.
      - 5) Off-site fabrication.
      - 6) Access.
      - 7) Site utilization.
      - 8) Temporary facilities and controls.
      - 9) Progress cleaning.
      - 10) Quality and work standards.
      - 11) Status of correction of deficient items.
      - 12) Field observations.
      - 13) Status of RFIs.
      - 14) Status of proposal requests.
      - 15) Pending changes.
      - 16) Status of Change Orders.
      - 17) Pending claims and disputes.
      - 18) Documentation of information for payment requests.
  3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

- a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- E. Project Closeout Conference: Conduct conference prior to Substantial Completion.
1. Attendees: Owner, Architect/ Consultant, Contractor.
  2. Agenda: Procedures for completing and archiving closeout deliverables in e-Builder;
    - a. Requirements for preparing Record Documents;
    - b. Requirements for preparing O&Ms;
    - c. Submittal of warranties;
    - d. Requirements for delivery of Maintenance stock;
    - e. Requirements for demonstration and training.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

## PART 1 - GENERAL

## 1.1 1.1 SECTION INCLUDES

- A. Summary.
- B. General Requirements
- C. System Requirements.
- D. System Access.
- E. System Use.

## 1.2 SUMMARY

- A. Project Management Communications: The Owner, Contractor and Architect shall use the Internet web based project Management communications tool, E-Builder ASP software and protocols included in that software during this project. The use of project management communications as herein described does not replace or change any contractual responsibilities of the participants.
- B. Purpose: The intent of using e-Builder is to improve project work efforts by promoting timely initial communications and responses and to reduce the number of paper documents while providing improved record keeping by creation of electronic document files.

## 1.3 General Requirements:

- A. Project management communications is available through e-Builder as provided by “e-Builder” in the form and manner required by the Owner.
- B. The project communications database is on-line and fully functional. User registration, electronic and computer equipment, and internet connections are the responsibility of each project participant. The sharing of user accounts is prohibited.
- C. Support: e-Builder will provide on-going support through on-line help files and with website’s training documents uploaded to the project folder.
- D. Authorized Users: Access to the web site will be by individuals who are licensed users as required by the Owner.
- E. Licenses Granted by Owner’s Representative: Owner shall pay for and provide licenses/access for the following members of the project team.
  - 1. Lead member of Architect’s/Consultant’s design team responsible.
  - 2. Contractor’s project manager or lead member of Contractor’s project staff.
  - 3. Others as deemed appropriate by Owner’s Representative.

#### 1.4 SYSTEM REQUIREMENTS:

##### A. System Configuration:

1. PC system 500 MHz Intel Pentium III or equivalent AMD processor.
2. 128 MB Ram.
3. Display capable of SVGA (1024 x 768 pixels) 256 colors display.
4. 101 key keyboard.
5. Mouse or other pointing device.

##### B. Operating System and software configuration:

1. All software shall be properly licensed with vendors or developers. Use of “e-Builder” does not convey any rights or licensure for use of any software, hardware or internet service provider.
2. Software Configuration:
  - a. Most current version of Microsoft Internet Explorer (current version is a free distribution for download). This specification is not intended to restrict the host server or client computers provided that industry standard HTTP clients ay access the published content.
  - b. Most current version of Adobe Acrobat Reader (Current version is a free distribution for download).
  - c. Other plug-ins specified by e-Builder as applicable to the system (current versions are a free distribution for download from [www.e-builder.net](http://www.e-builder.net)).
  - d. Users are recommended to have a properly licensed version of the standard Microsoft Office Suite (current version must be purchased) or the equivalent.

#### 1.5 SYSTEM ACCESS

- A. Minimum Equipment and Internet Connection: In addition to other requirements specified in this Section, the Contractor shall be responsible for providing suitable computer systems for each licensed user at the user’s normal work location with high-speed Internet access, i.e. DSL, local cable company’s Internet connection, or T1 connection.
- B. Authorized users will be contacted directly by the web site provider, e-Builder, who will assign the temporary user password.
- C. Individuals shall be responsible for the proper use of their passwords and access to data as agents of the company in which they are employed.

#### 1.6 SYSTEM USE

- A. Owner’s Administrative Users: Owner administrative users have access and control of user licenses and all posted items. **DO NOT POST PRIVATE OR YOUR COMPANY’S CONFIDENTIAL ITEMS IN THE DATABASE!**
- B. Improper or abusive language toward any party or repeated posting of items intended to deceive or disrupt the work of the project will not be tolerated and will result in deletion of the offensive items and revocation of user license at the sole discretion of the Administrative User(s). Costs incurred or associated with such issues shall be the financial responsibility of the party responsible for the transgression.

- C. Communications: Communication for this project for the items listed below shall be solely through e-Builder:
1. RFI, Requests for Information.
  2. Change Order Requests.
  3. Architect's Supplemental Instructions.
  4. All other communication shall be conducted in an industry standard manner.
  5. Submittals, contracts, meeting minutes, and other project records.
  6. Application for payments.
  7. Project closeout.
- D. Document Integrity and Revisions:
1. Documents, comments, drawings and other records posted to the system shall remain for the project record. The authorship time and date shall be recorded for each document submitted to the system. Submitting a new document or record with a unique ID, authorship, and time stamp shall be the method used to make modifications or corrections.
  2. The system shall identify revised or superseded documents and their predecessors.
  3. Server or Client side software enhancements during the life of the project shall not alter or restrict the content of data published by the system. System upgrades shall not affect access to older documents or software.
- E. Document security: The system shall provide a method for communications of documents. Documents shall allow security group assignment to respect the contractual parties communication except for Administrative Users.
- F. Document Integration: Documents of various types shall be logically related to one another and discoverable,.
- G. Notifications and Distribution: Document distribution to project members shall be accomplished both within the extranet system and via email as appropriate. Project document distribution to parties outside of the project communication system shall be accomplished by secure email of outgoing documents and attachments readable by a standard email client.
- H. Ownership of Documents and Information: All documents, files or other information posted on the system shall become the property of the Owner.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

## PART 1 - GENERAL

## 1.1 CONSTRUCTION PROGRESS DOCUMENTATION

- A. Progress Schedules and Reports: The Contractor, within ten calendar days after being awarded the Contract, shall prepare and submit for the information of the Owner's Representative and the Architect/Consultant a Progress Schedule in critical path management ("CPM") format satisfactory to the Owner's Representative for the Work. The Progress Schedule shall conform to any requirements of the Specifications, shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, shall provide for expeditious and practicable execution of the Work and shall be utilized and conformed to by the Contractor and its Subcontractors. Contractor shall comply with the Progress Schedule. The Progress schedule is for the District's benefit, and to the full extent permitted by law, changes to or variations from the Progress Schedule shall not entitle the Contractor to an extension of the Contract Time or increase of Contract Sum.
  
- B. Meeting Minutes: Contractor shall be responsible for the preparation and distribution of meeting minutes.

END OF SECTION

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

### 1.2 QUALITY CONTROL

- A. Submit 3-week work schedule, shop drawings, product data, samples, schedule of values and record documents as follows:
  - 1. Submit to Architect/Consultant and Owner's Representative only through General Contractor.
  - 2. The General Contractor shall provide a set of submittals to the Owner's Representative for review and approval concurrent with review by the Architect and Consultant(s).

### 1.3 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's/ Consultant's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
  - 1. Architect/Consultant will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings.
    - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    - b. Digital data files are provided for Contractor's convenience and to help expedite the submittal preparation process. Use of the digital data files is at Contractor's risk and does not release the Contractor from verifying and indicating as-built conditions which may or may not be indicated in the digital data files.
    - c. Contractor shall execute a release of Architect's/Consultant's liability for Contractor's use of the digital data files. Release form shall be provide by Architect/Consultant.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect and Consultant reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect/Consultant's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect/Consultant or Owner's Representative will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Identification and Information: Place a permanent label or title block on each paper copy submittal item for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
  2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect/Consultant.
  3. Include the following information for processing and recording action taken:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Construction Manager.
    - e. Name of Contractor.
    - f. Name of subcontractor.
    - g. Name of supplier.
    - h. Name of manufacturer.
    - i. Submittal number or other unique identifier, including revision identifier.
      - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
    - j. Number and title of appropriate Specification Section.
    - k. Drawing number and detail references, as appropriate.
    - l. Location(s) where product is to be installed, as appropriate.
    - m. Other necessary identification.
- E. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file with links enabling navigation to each item.
  2. Name file with submittal number or other unique identifier, including revision identifier.
    - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01).

Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect/ Consultant.
  4. Include the following information on an inserted cover sheet:
    - a. Project name.
    - b. Date.
    - c. Name and address of Architect.
    - d. Name of Construction Manager.
    - e. Name of Contractor.
    - f. Name of firm or entity that prepared submittal.
    - g. Name of subcontractor.
    - h. Name of supplier.
    - i. Name of manufacturer.
    - j. Number and title of appropriate Specification Section.
    - k. Drawing number and detail references, as appropriate.
    - l. Location(s) where product is to be installed, as appropriate.
    - m. Related physical samples submitted directly.
    - n. Other necessary identification.
- F. Options: Identify options requiring selection by the Architect.
- G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
  2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  3. Resubmit submittals until they are marked with approval notation from Architect's/ Consultant's action stamp.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Use only final submittals that are marked with approval notation from Architect's or Consultant's action stamp.

## PART 2 - PRODUCTS

### 2.1 SUBMITTAL PROCEDURES

#### A. General Submittal Procedure Requirements:

1. Post electronic submittals as PDF electronic files directly to e-Builder.
  - a. Architect/Consultant will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures." All closeout submittals to be uploaded to e-Builder in format acceptable to the District.
  3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
    - a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
    - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
  4. Test and Inspection Reports Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Standard color charts.
    - d. Statement of compliance with specified referenced standards.
    - e. Testing by recognized testing agency.
    - f. Application of testing agency labels and seals.
    - g. Notation of coordination requirements.
    - h. Availability and delivery time information.
  4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams showing factory-installed wiring.
    - b. Printed performance curves.
    - c. Operational range diagrams.
    - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
  5. Submit Product Data before or concurrent with Samples.
  6. Submit Product Data in the following format:
    - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data without field-verifying as-built conditions which may or may not be indicated at part of the released digital data files.

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

containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

- a. Number of Samples: Submit three sets of Samples. Architect/Consultant will retain two Sample sets; remainder will be returned.
  - 1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
  1. Submit product schedule in the following format:
    - a. PDF electronic file.
- F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- G. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."
- H. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design.
  1. Submit subcontract list in the following format:
    - a. PDF electronic file.
- J. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.
- M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

- N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- R. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- T. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."
- U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- W. Field Test Reports: Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- X. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

## PART 3 - EXECUTION

## 3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect/Consultant and Owner's Representative.
- B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 01 Section "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

## 3.2 ARCHITECT'S/ CONSULTANT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect/ Consultant will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect or Consultant will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- C. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- D. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION

## PART 1 - GENERAL

## 1.1 CONSTRUCTION/ MAINTENANCE BUILDING SECURITY RULES

- A. The Contractor shall enforce strict discipline and good order among the Contractor's employees, Subcontractors, and other persons carrying out the contract on District property. The District may require that the Contractor immediately remove from the project site and District property any employee or other person carrying out the contract that the District considers objectionable.
- B. District Personnel (i.e., Building Administrator, Custodian, or a building monitor etc.) must be present when a contractor is performing work within an existing school facility.
- C. Only District Personnel will deactivate the security system upon arriving and reactivate the system when they leave the facility.
  - 1. If the responsible District Personnel for a particular day changes during the day, the District Personnel shall coordinate this change in responsibility and advise the contractor's superintendent.
- D. Contractor personnel will not be furnished District security badges and/or access codes to the Building security system.
- E. The Contractor shall have a responsible party such as a superintendent, foreman, or supervisor on site during any work being performed by either their own forces or that of their subcontractors.
- F. The superintendent shall check in with the responsible District Personnel upon arrival and advise when all work is complete, contract personnel have left, and the area is secure.
- G. The Contractor's superintendent shall be responsible for security in areas where work is being performed as well as ingress and egress to that area.
- H. At the Owner's Representative's discretion, the superintendent may be issued a building key to allow access to areas where work is being performed.
- I. The superintendent shall maintain a daily log defining what areas within the building were accessed by Contractor personnel, which personnel from their firm were in the building, and which subcontracting firms were in the building.,
- J. Each of the Contractor's employees, Subcontractors' employees, and principals/owners involved at the site may, at the option of the District, be subject to a security check, at any time, through the Beaverton Police Department or other authority.
- K. Contractor shall perform or have performed criminal background checks for every employee on all active campus (i.e., children are present) projects prior to that employee's admittance to the project site. Once an employee passes the criminal background check, the Contractor will provide an ID badge and a hard hat sticker which they must wear while they are on site at all times. Contractor may be fined up to \$500 for every worker working on site without the proper

ID badge and a hat sticker. The following are the convicted crimes that may appear on the background check, as listed in ORS 342.143, most recent edition to include:

- Aggravated Murder of Murder
- Assault in the First Degree
- Kidnapping in the First Degree
- Rape in the First, Second, or Third Degree
- Sodomy in the First, Second, or Third Degree
- Unlawful Sex Penetration in the First or Second Degree
- Arson in the First Degree
- Sexual Abuse in the First, Second, or Third Degree
- Contributing to the Sexual Delinquency of a Minor
- Sexual Misconduct
- Public Misconduct
- Public Indecency
- Bigamy
- Incest
- Child Neglect in the First Degree
- Endangering the Welfare of a Minor
- Using Child in Display of Sexually Explicit Conduct
- Sale or Exhibition of Visual Reproduction of Sexual Conduct by a Child
- Paying for Viewing of Sexual Conduct Involving a Child
- Encouraging Child Sex Abuse in First, Second or Third Degree
- Possession of Materials Depicting Sexual Explicit Conduct of a Child in the First or Second Degree
- Arson in the First Degree
- Robbery in the First Degree
- Treason
- Abuse of a Corpse in the First Degree
- Prostitution, Promoting Prostitution, or Compelling Prostitution
- Sadoomasochistic Abuse or Sexual Conduct in a Live Show
- Furnishing, Sending, or Displaying Obscene Materials to Minors
- Exhibiting an Obscene Performance to a Minor
- Disseminating Obscene Materials
- Publicly Displaying Nudity or Sex for Advertising Purposes
- Distribution of Controlled Substance to Minors
- Manufacture or Delivery of Controlled Substance to Minor or Student within 1000 Feet of a School
- Attempt to Commit Any of the Above-Listed Crimes

L. Background screening firm qualifications:

1. Must have a minimum of five years of screening experience specifically for construction industry clients.
2. Must have a minimum of fifteen employees
3. Must be able to provide access to an internet based screening management software system which has a feature to allow access by the District to view the pass-no pass result for each screened Contractor/Subcontractor employee working on a District project.
4. Must be accredited by the National Association of Professional Background Screeners (NAPBS)

- M. Smoking and any use of tobacco products is not allowed within 50 feet of the campus property. Contractor may be fined up to \$500 for each incident of tobacco use within the area of work by the Contractor or Subcontractors.
- N. Firearms are not allowed on campus property. Law enforcement will be contacted if any contractor personnel are in possession of a firearm on site (Including firearms located in a locked vehicle).
- O. Abusive, inappropriate, and/or foul language is strictly prohibited on active campus projects. Employees who abuse this rule will be asked to leave the project site.
- P. ID Badge are to contain:
  - 1. Individual's full name (no nicknames)
  - 2. Individual's company affiliation
  - 3. Recent photograph of the individual; taken within the last 4 years.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Consultant, Owner's Representative, or authorities having jurisdiction are not limited by provisions of this Section.

### 1.2 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

### 1.3 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
  - 1. Date of issue.
  - 2. Project title and number.
  - 3. Name, address, and telephone number of testing agency.
  - 4. Dates and locations of samples and tests or inspections.
  - 5. Names of individuals making tests and inspections.
  - 6. Description of the Work and test and inspection method.
  - 7. Identification of product and Specification Section.
  - 8. Complete test or inspection data.
  - 9. Test and inspection results and an interpretation of test results.

10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  5. Other required items indicated in individual Specification Sections.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

#### 1.4 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect/Consultant and Owner's Representative with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

## 1.5 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.

3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. **Manufacturer's Field Services:** Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.
- D. **Retesting/Reinspecting:** Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. **Testing Agency Responsibilities:** Cooperate with Architect, Consultant, Owner's Representative and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect/Consultant, Owner's Representative and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. Do not perform any duties of Contractor.
- F. **Associated Services:** Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. **Coordination:** Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

#### 1.6 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner's Representative will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
  2. Notifying Architect/Consultant and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
  3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect/Consultant and Owner's Representative with copy to Contractor and to authorities having jurisdiction.
  4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
  5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
  6. Retesting and reinspecting corrected work.

#### PART 2 - PRODUCTS (Not Used)

#### PART 3 - EXECUTION

##### 3.1 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

## PART 1 - GENERAL

### 1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

### 1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

### 1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

AA	Aluminum Association, Inc. (The)
AAADM	American Association of Automatic Door Manufacturers
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ABAA	Air Barrier Association of America
ABMA	American Bearing Manufacturers Association
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
AEIC	Association of Edison Illuminating Companies, Inc. (The)
AF&PA	American Forest & Paper Association
AGA	American Gas Association
AGC	Associated General Contractors of America (The)
AHA	American Hardboard Association (Now part of CPA)
AHAM	Association of Home Appliance Manufacturers
AI	Asphalt Institute
AIA	American Institute of Architects (The)

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AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALCA	Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network)
ALSC	American Lumber Standard Committee, Incorporated
AMCA	Air Movement and Control Association International, Inc.
ANSI	American National Standards Institute
AOSA	Association of Official Seed Analysts, Inc.
APA	Architectural Precast Association
APA	APA - The Engineered Wood Association
APA EWS	APA - The Engineered Wood Association; Engineered Wood Systems (See APA - The Engineered Wood Association)
API	American Petroleum Institute
ARI	Air-Conditioning & Refrigeration Institute
ARMA	Asphalt Roofing Manufacturers Association
ASCE	American Society of Civil Engineers
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	ASME International (American Society of Mechanical Engineers International)
ASSE	American Society of Sanitary Engineering
ASTM	ASTM International (American Society for Testing and Materials International)
AWCI	Association of the Wall and Ceiling Industry
AWCMA	American Window Covering Manufacturers Association (Now WCMA)
AWI	Architectural Woodwork Institute

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AWPA	American Wood Protection Association (Formerly: American Wood Preservers' Association)
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association (The)
BICSI	BICSI, Inc.
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International)
BISSC	Baking Industry Sanitation Standards Committee
BWF	Badminton World Federation (Formerly: IBF - International Badminton Federation)
CCC	Carpet Cushion Council
CDA	Copper Development Association
CEA	Canadian Electricity Association
CEA	Consumer Electronics Association
CFFA	Chemical Fabrics & Film Association, Inc.
CGA	Compressed Gas Association
CIMA	Cellulose Insulation Manufacturers Association
CISCA	Ceilings & Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CRRC	Cool Roof Rating Council
CPA	Composite Panel Association
CPPA	Corrugated Polyethylene Pipe Association
CRI	Carpet and Rug Institute (The)
CRSI	Concrete Reinforcing Steel Institute

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CSA	Canadian Standards Association
CSA	CSA International (Formerly: IAS - International Approval Services)
CSI	Cast Stone Institute
CSI	Construction Specifications Institute (The)
CSSB	Cedar Shake & Shingle Bureau
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute)
DHI	Door and Hardware Institute
EIA	Electronic Industries Alliance
EIMA	EIFS Industry Members Association
EJCDC	Engineers Joint Contract Documents Committee
EJMA	Expansion Joint Manufacturers Association, Inc.
ESD	ESD Association (Electrostatic Discharge Association)
ETL SEMCO	Intertek ETL SEMCO (Formerly: ITS - Intertek Testing Service NA)
FIBA	Federation Internationale de Basketball (The International Basketball Federation)
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation)
FM Approvals	FM Approvals LLC
FM Global	FM Global (Formerly: FMG - FM Global)
FMRC	Factory Mutual Research (Now FM Global)
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.
FSA	Fluid Sealing Association
FSC	Forest Stewardship Council

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GA	Gypsum Association
GANA	Glass Association of North America
GRI	(Part of GSI)
GS	Green Seal
GSI	Geosynthetic Institute
HI	Hydraulic Institute
HI	Hydronics Institute
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)
HPVA	Hardwood Plywood & Veneer Association
HPW	H. P. White Laboratory, Inc.
IAS	International Approval Services (Now CSA International)
IBF	International Badminton Federation (Now BWF)
ICEA	Insulated Cable Engineers Association, Inc.
ICRI	International Concrete Repair Institute, Inc.
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)
IESNA	Illuminating Engineering Society of North America
IEST	Institute of Environmental Sciences and Technology
IGCC	Insulating Glass Certification Council
IGMA	Insulating Glass Manufacturers Alliance
ILI	Indiana Limestone Institute of America, Inc.
ISO	International Organization for Standardization Available from ANSI
ISSFA	International Solid Surface Fabricators Association
ITS	Intertek Testing Service NA

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	(Now ETL SEMCO)
ITU	International Telecommunication Union
KCMA	Kitchen Cabinet Manufacturers Association
LMA	Laminating Materials Association (Now part of CPA)
LPI	Lightning Protection Institute
MBMA	Metal Building Manufacturers Association
MFMA	Maple Flooring Manufacturers Association, Inc.
MFMA	Metal Framing Manufacturers Association, Inc.
MH	Material Handling (Now MHIA)
MHIA	Material Handling Industry of America
MIA	Marble Institute of America
MPI	Master Painters Institute
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
NAAMM	National Association of Architectural Metal Manufacturers
NACE	NACE International (National Association of Corrosion Engineers International)
NADCA	National Air Duct Cleaners Association
NAGWS	National Association for Girls and Women in Sport
NAIMA	North American Insulation Manufacturers Association
NBGQA	National Building Granite Quarries Association, Inc.
NCAA	National Collegiate Athletic Association (The)
NCMA	National Concrete Masonry Association
NCPI	National Clay Pipe Institute
NCTA	National Cable & Telecommunications Association
NEBB	National Environmental Balancing Bureau

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NECA	National Electrical Contractors Association
NeLMA	Northeastern Lumber Manufacturers' Association
NEMA	National Electrical Manufacturers Association
NETA	InterNational Electrical Testing Association
NFHS	National Federation of State High School Associations
NFPA	NFPA (National Fire Protection Association)
NFRC	National Fenestration Rating Council
NGA	National Glass Association
NHLA	National Hardwood Lumber Association
NLGA	National Lumber Grades Authority
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association)
NOMMA	National Ornamental & Miscellaneous Metals Association
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSF	NSF International (National Sanitation Foundation International)
NSSGA	National Stone, Sand & Gravel Association
NTMA	National Terrazzo & Mosaic Association, Inc. (The)
NTRMA	National Tile Roofing Manufacturers Association (Now TRI)
NWWDA	National Wood Window and Door Association (Now WDMA)
OPL	Omega Point Laboratories, Inc. (Now ITS)
PCI	Precast/Prestressed Concrete Institute
PDCA	Painting & Decorating Contractors of America
PDI	Plumbing & Drainage Institute

PGI	PVC Geomembrane Institute
PLANET	Professional Landcare Network (Formerly: ACLA - Associated Landscape Contractors of America)
PTI	Post-Tensioning Institute
RCSC	Research Council on Structural Connections
RFCI	Resilient Floor Covering Institute
RIS	Redwood Inspection Service
SAE	SAE International
SDI	Steel Deck Institute
SDI	Steel Door Institute
SEFA	Scientific Equipment and Furniture Association
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)
SGCC	Safety Glazing Certification Council
SIA	Security Industry Association
SIGMA	Sealed Insulating Glass Manufacturers Association (Now IGMA)
SJI	Steel Joist Institute
SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SMPTE	Society of Motion Picture and Television Engineers
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division)
SPIB	Southern Pine Inspection Bureau (The)
SPRI	Single Ply Roofing Industry
SSINA	Specialty Steel Industry of North America

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SSPC	SSPC: The Society for Protective Coatings
STI	Steel Tank Institute
SWI	Steel Window Institute
SWRI	Sealant, Waterproofing, & Restoration Institute
TCA	Tile Council of America, Inc. (Now TCNA)
TCNA	Tile Council of North America, Inc.
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance
TMS	The Masonry Society
TPI	Truss Plate Institute, Inc.
TPI	Turfgrass Producers International
TRI	Tile Roofing Institute
UL	Underwriters Laboratories Inc.
UNI	Uni-Bell PVC Pipe Association
USAV	USA Volleyball
USGBC	U.S. Green Building Council
USITT	United States Institute for Theatre Technology, Inc.
WASTECH	Waste Equipment Technology Association
WCLIB	West Coast Lumber Inspection Bureau
WCMA	Window Covering Manufacturers Association
WCSC	Window Covering Safety Council (Formerly: WCMA - Window Covering Manufacturers Association)
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association)
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California)
WIC	Woodwork Institute of California (Now WI)
WMMPA	Wood Moulding & Millwork Producers Association

WSRCA Western States Roofing Contractors Association

WWPA Western Wood Products Association

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

IAPMO International Association of Plumbing and Mechanical Officials

ICC International Code Council

ICC-ES ICC Evaluation Service, Inc.

UBC Uniform Building Code  
(See ICC)

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE Army Corps of Engineers

CPSC Consumer Product Safety Commission

DOC Department of Commerce

DOD Department of Defense

DOE Department of Energy

EPA Environmental Protection Agency

FAA Federal Aviation Administration

FCC Federal Communications Commission

FDA Food and Drug Administration

GSA General Services Administration

HUD Department of Housing and Urban Development

LBL Lawrence Berkeley National Laboratory

NCHRP National Cooperative Highway Research Program  
(See TRB)

NIST National Institute of Standards and Technology

OSHA	Occupational Safety & Health Administration
PBS	Public Buildings Service (See GSA)
PHS	Office of Public Health and Science
RUS	Rural Utilities Service (See USDA)
SD	State Department
TRB	Transportation Research Board
USDA	Department of Agriculture
USPS	Postal Service

- E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board
CFR	Code of Federal Regulations Available from Government Printing Office
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point
DSCC	Defense Supply Center Columbus (See FS)
FED-STD	Federal Standard (See FS)
FS	Federal Specification Available from Department of Defense Single Stock Point  Available from Defense Standardization Program  Available from General Services Administration  Available from National Institute of Building Sciences
FTMS	Federal Test Method Standard (See FS)

MIL (See MILSPEC)

MIL-STD (See MILSPEC)

MILSPEC Military Specification and Standards  
Available from Department of Defense Single Stock Point

UFAS Uniform Federal Accessibility Standards  
Available from Access Board

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CBHF State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation

CCR California Code of Regulations

CPUC California Public Utilities Commission

TFS Texas Forest Service  
Forest Resource Development

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

### 1.2 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect/Consultant, Owner's Representative, testing agencies, and authorities having jurisdiction. Temporary facilities required for the project include but may not be limited to:

1. Sanitary Facilities
2. Telephone/Fax
3. Internet

- B. Water from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

### 1.3 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

### 1.4 QUALITY ASSURANCE

- A. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

### 1.5 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its

use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

## PART 2 - PRODUCTS

### 2.1 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

### 2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
  - 1. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction and clean HVAC system as required in Division 01 Section "Closeout Procedures."

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
  - 1. Locate facilities to limit site disturbance as specified in Division 01 Section "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
  - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
  - 1. Provide portable facilities as required for workmen. Keep facilities clean and in sanitary condition. Remove from the site upon completion of the Work.

- C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- D. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- F. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
  - 1. Connect temporary service to Owner's existing power source, as directed by Owner.
- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
  - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
  - 2. At a conspicuous place within the primary field office post a list of important telephone numbers, including:
    - a. Police and fire departments.
    - b. Ambulance service.
    - c. Contractor's home office.
    - d. Architect's office.
    - e. Engineers' offices.
    - f. Owner's Representative's office.
    - g. Principal subcontractors' field and home offices.

### 3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- B. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- C. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.
- D. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
1. Prohibit smoking in construction areas.
  2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
  3. Develop and supervise an overall fire-prevention -and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
  4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

### 3.4 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

### 3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
  2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION

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PART 1 - GENERAL

1.1 MATERIAL AND EQUIPMENT SELECTION

- A. Comply with standards and these specifications including size, make, type, and quality specified, or as accepted in writing by the Architect/Consultant and Owner's Representative.
- B. All products shall be new and of current manufacture unless otherwise specified.
- C. All similar products shall be of the same manufacturer.
- D. Manufactured and Fabricated Products:
  - 1. Design, fabricate, and assemble in accordance with the best engineering and shop practices.
  - 2. Manufacture like parts of duplicate units to standard sizes and gauges and to be interchangeable.
  - 3. All similar products shall be of the same manufacturer. Two or more items of the same kind shall be considered identical and by the same manufacturer.
  - 4. Provide products suitable for service conditions.
  - 5. Adhere to equipment capacities, sizes, and dimensions shown or specified unless variations are specifically approved in writing by the Architect/Consultant or Owner's Representative.
- E. Do not use material or equipment for any purpose other than that for which it is designed or is specified.
- F. Fabricate and install equipment to deliver its full rated capacity at the efficiency for which it was designed.
- G. Select and install equipment to operate at full capacity without excessive noise or vibration.
- H. Provide electrical products with Underwriter's Laboratories Label or as approved by the local inspection authority.
- I. Any software provided with products shall be provided with appropriate licensing and use agreements for a minimum of 10 years.

1.2 MANUFACTURER'S INSTRUCTIONS

- A. Perform work in accordance with manufacturer's printed installation instructions, obtain and distribute copies of such instructions to parties involved in the installation, including submittal to the Architect through the Owner's Project Management Database (e-Builder).\
- B. Maintain one set of complete instructions at the job site during installation and until completion.
- C. Handle, install, connect, clean, condition, and adjust products in strict accordance with manufacturer's printed instructions and in conformity with specified requirements.

1. Consult with Architect/Consultant for further instructions should job conditions or specified requirements conflict with manufacturer's instructions.
  2. Do not proceed with work without clear instructions.
- D. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. Installation of the Work.
  - 4. Coordination of Owner-installed products.
  - 5. Progress cleaning.
  - 6. Starting and adjusting.
  - 7. Protection of installed construction.
  - 8. Correction of the Work.
- B. Related Sections:
  - 1. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
  - 2. Division 01 Section "Cutting and Patching".

### 1.2 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

### 1.3 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the Architect and Owner's Representative for the visual and functional performance of in-place materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
  1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
  2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner's Representative that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to Architect/ Consultant according to requirements in Division 01 Section "Project Management and Coordination."

### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and as-built conditions. If discrepancies are discovered, notify Architect/ Consultant promptly.

### 3.4 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
  - 1. Allow for building movement, including thermal expansion and contraction.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.5 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
  - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
  - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  - 1. Remove liquid spills promptly.
  - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.6 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "Quality Requirements."

### 3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

### 3.8 CORRECTION OF THE WORK

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

END OF SECTION

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.

### 1.2 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

### 1.3 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials. Submit 3 samples for Architect and Owner approval.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
  - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.

2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

### 3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
  5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
  4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017329

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
1. Substantial Completion procedures.
  2. Final completion procedures.
  3. Asbestos free material statement.
  4. Warranties.
  5. Final cleaning.

### 1.2 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete with request.
1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  2. Advise Owner's Representative of pending insurance changeover requirements.
  3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  5. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
  6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
  7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  8. Complete startup testing of systems.
  9. Submit test/adjust/balance records.
  10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  11. Advise Owner of changeover in heat and other utilities.
  12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
  13. Complete final cleaning requirements, including touchup painting.
  14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
  15. Prepare Closeout Log: An electronic spreadsheet log listing all closeout deliverables required in the specifications including contractor's record drawings, warranties, shop drawings, product data, extra stock, training and O&Ms. See Sample Closeout Log provided in at the end of this section.

- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect, Consultant and Owner's Representative will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for final completion.

### 1.3 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
  2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit pest-control final inspection report and warranty.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect, Consultant and Owner's Representative will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

### 1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in a sequential order.
  2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  3. Submit list of incomplete items in the following format:
    - a. PDF electronic file.

### 1.5 ASBESTOS FREE MATERIALS STATEMENT

- A. Submittal: Provide written statement from general contractor certifying no products or materials containing asbestos were used in the project.
- B. Timing: Submit with substantial completion.
- C. Format: Electronic copy is acceptable with final delivery of hard copy at final closeout.

### 1.6 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
  - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
  - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
  - 4. Scan warranties and bonds and assemble complete warranty and bond submittal package into individual PDF files organized by specification section.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
  - 1. Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

## PART 3 - EXECUTION

## 3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Remove snow and ice to provide safe access to building.
    - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - h. Sweep concrete floors broom clean in unoccupied spaces.
    - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
    - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
    - k. Remove labels that are not permanent.
    - l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
      - 1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.
    - m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

- n. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
- o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
- q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
- r. Leave Project clean and ready for occupancy.

END OF SECTION

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operations and Maintenance Manual.
- B. See Divisions 02 through 49 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

### 1.2 SUBMITTALS

- A. Manual: Submit electronic manual in final form at least 15 days before final inspection. Architect/Consultant and Owner's Representative will return an electronic copy with comments within 15 days after final inspection.
  - 1. Correct or modify each manual to comply with Architect's comments. Submit final electronic copy of each corrected manual within 15 days of receipt of Architect's/Consultant's and Owner's Representative's comments.

## PART 2 - PRODUCTS

### 2.1 MANUAL, GENERAL

- A. Organization: Unless otherwise indicated, organize manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. The manual shall contain a title page, table of contents, and manual contents.
- B. Title Page: Include the following information:
  - 1. Subject matter included in manual.
  - 2. Name and address of Project.
  - 3. Name and address of Owner.
  - 4. Date of submittal.
  - 5. Name, address, and telephone number of Contractor.
  - 6. Name and address of Architect.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- D. Manual Contents: Arrange contents numerically by specification section.

## OPERATION INFORMATION

- E. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and equipment descriptions, operating standards, operating procedures, operating logs, wiring and control diagrams, and license requirements.
- F. Descriptions: Include the following:
  - 1. Product name and model number.
  - 2. Manufacturer's name.
  - 3. Equipment identification with serial number of each component.
  - 4. Equipment function.
  - 5. Operating characteristics.
  - 6. Limiting conditions.
  - 7. Performance curves.
  - 8. Engineering data and tests.
  - 9. Complete nomenclature and number of replacement parts.
- G. Operating Procedures: Include start-up, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.
- H. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- I. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## PRODUCT MAINTENANCE INFORMATION

- J. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- K. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- L. Product Information: Include the following, as applicable:
  - 1. Product name and model number.
  - 2. Manufacturer's name.
  - 3. Color, pattern, and texture.
  - 4. Material and chemical composition.
  - 5. Reordering information for specially manufactured products.
- M. Maintenance Procedures: Include manufacturer's written recommendations and inspection procedures, types of cleaning agents, methods of cleaning, schedule for cleaning and maintenance, and repair instructions.

- N. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- O. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

#### SYSTEMS AND EQUIPMENT MAINTENANCE INFORMATION

- P. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- Q. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- R. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment:
- S. Maintenance Procedures: Include test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions that detail essential maintenance procedures:
- T. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- U. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- V. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- W. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

### PART 3 - EXECUTION

#### 3.1 MANUAL PREPARATION

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

- B. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- C. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- D. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original Project Record Documents as part of operation and maintenance manuals.
- E. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
- B. See Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
- C. See Divisions 02 through 49 Sections for specific requirements for Project Record Documents of the Work in those Sections.

### 1.2 SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit copies of Record Drawings as follows:
    - a. Submit one set of marked-up Record Prints, and the following:
      - 1) Record CAD Drawing Files and Plots: One set.
      - 2) Copies printed from Record CAD Drawing Plots: Three. Plot and print each Drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one copy copies of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one copy of each Product Data submittal.

## PART 2 - PRODUCTS

### 2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
  - 1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

- a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
  2. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
  3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record CAD Drawings: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect. When authorized, prepare a full set of corrected CAD Drawings of the Contract Drawings, as follows:
1. Format: Same CAD program, version, and operating system as the original Contract Drawings.
  2. Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable.
  3. Refer instances of uncertainty to Architect for resolution.
  4. Architect will furnish Contractor one set of CAD Drawings of the Contract Drawings for use in recording information.
- C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into single PDF file.
  2. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.
  3. Record CAD Drawings: Organize CAD information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each CAD file.
  4. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Architect.
    - e. Name of Contractor.

## 2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

### 2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

### 2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

## PART 3 - EXECUTION

### 3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION

## PART 1 - GENERAL

## 1.1 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to Final Completion or acceptance, fully instruct the Owner's Designated Representative and maintenance personnel in the operation, adjustment, and maintenance of all products, equipment, and systems.
  - 1. The District reserves the right to videotape training sessions.
  
- B. Operating and maintenance manual shall constitute the basis of instruction.
  - 1. Review contents of manual with Owner's personnel in full detail to explain all aspects of operations and maintenance.
  - 2. Review complete heating and cooling cycles with Owner's Designated Representative. Review location of dampers, valves, and control equipment.

END OF SECTION

## 1 GENERAL

## 1.01 PURPOSE

- A. This Section includes the general requirements that apply to the implementation of the commissioning process.
- B. Commissioning is a systematic process that provides documented confirmation that the building systems perform according to the criteria set forth in the design intent defined in the Basis of Design and satisfy the operational needs defined in the Owner's Project Requirements.
- C. Commissioning during the construction phase is intended to achieve the following specific objectives:
  - 1. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by the installing contractors.
  - 2. Verify and document proper performance of equipment and systems.
  - 3. Verify that O&M documentation left on site is complete.
  - 4. Verify that the Owner's operating personnel are adequately trained.

## 1.02 ABBREVIATIONS

A/E-	Architect and design engineers	GC-	General contractor (prime)
CxA-	Commissioning authority	MC-	Mechanical contractor
CC-	Controls contractor	OR-	Owner's Representative
CM-	Construction Manager	PFC-	Pre-functional checklist
Cx-	Commissioning	PM-	Project manager (of the Owner)
EC-	Electrical contractor	Subs-	Subcontractors to General
FTP-	Functional Test Procedure	TAB-	Test and balance contractor

## 1.03 DEFINITIONS

- A. Owner's Project Requirements (OPR): A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

- B. Basis of Design (BOD) Basis of Design: A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
- C. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process as dictated by the Commissioning Specification.
- D. Pre-Functional Checklist (PFC): A list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CxA to the contractors. Pre-functional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some pre-functional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three-phase pump motor of a chiller system). The word pre-functional refers to before functional testing. Pre-functional checklists augment and are combined with the manufacturer's start-up checklist. Even without a commissioning process, contractors typically perform some, if not many, of the pre-functional checklist items a commissioning authority will recommend. However, few contractors document in writing the execution of these checklist items. Therefore, for most equipment, the contractors execute the checklists on their own. The commissioning authority only requires that the procedures be documented in writing and does not witness much of the pre-functional checklist completion, except for larger or more critical pieces of equipment.
- E. Sampling: Functionally testing only a fraction of the total number of identical or near identical pieces of equipment.
- F. Functional Test Procedure (FTP): Test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which

has already been set up. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FTPs are performed after pre-functional checklists and startup are complete.

- G. Issue Log (IL): A formal and ongoing record of problems or concerns – and their resolution – that has been raised by members of the Commissioning Team during the course of the Commissioning Process.

#### 1.04 RELATED WORK SPECIFIED ELSEWHERE

A. Division 01 – General

1. 013100 Project Management and Coordination
2. 013300 Submittal Procedures
3. 017700 Closeout Procedures
4. 017823 Operation and Maintenance
5. 017900 Demonstration and Training

B. Division 23 – HVAC

1. 230500 Basic Materials and Methods
2. 230593 Testing, Adjusting, and Balancing

#### 1.05 RESPONSIBILITIES

A. Owner & Owner Representatives

1. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions.
2. Provide final approval for the completion of the commissioning work.
3. Ensure that any seasonal or deferred testing and any deficiency issues are addressed.
4. Attend commissioning kickoff meetings and additional meetings as necessary.

B. Commissioning Authority

1. The primary role of the CxA is to ensure that the commissioned systems meet the owner's project requirements and function according to the design intent. The CxA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CxA may assist with problem-solving non-conformance or deficiencies, but

ultimately that responsibility resides with the general contractor and the A/E.

- a. Coordinates and directs the commissioning activities
- b. Develops and updates the following commissioning documentation as necessary:
  - 1) Commissioning Plan
  - 2) Pre-functional Checklists (PFC)
  - 3) Commissioning Site Observation Reports
  - 4) Functional Test Procedures (FTP)
  - 5) Completed Functional Test Procedure (FTP) - as witnessed
  - 6) Issue Log (IL)
  - 7) Commissioning Report
- c. Reviews and provides input on the following commissioning documentation:
  - 1) Commissioning Schedule
  - 2) Commissioning Agenda and Meeting Minutes
  - 3) Equipment and Control Submittal related to commissioned systems
  - 4) Completed Pre-functional Checklists (PFC)
  - 5) Start-up Reports
  - 6) Training Agendas and completion verifications
  - 7) Operation and Maintenance Manuals related to commissioned systems
  - 8) Warranties related to commissioned systems
- d. Attend commissioning Kickoff meeting and other commissioning meetings.
- e. Perform site visits, as necessary, to observe component and system installations.
- f. Direct and witness functional testing as conducted by installing contractors.
- g. Analyze functional test procedure, trend logs and monitoring data to verify satisfactory operation.

C. Deferred Testing Coordination Engineer of Record

1. The EOR shall participate in and perform commissioning process activities including, but not limited to, the following:
  - a. Attend the commissioning kickoff meeting and selected commissioning team meetings.
  - b. Provide a Basis of Design.
  - c. Participate in the resolution of system deficiencies identified during commissioning.
  - d. Participate in the resolution of design non-conformance and design deficiencies identified during Functional testing and warranty-period commissioning.

D. General Contractor

1. Contractor shall assign a representative with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
  - a. Designate a Commissioning coordinator.
  - b. Coordinate and attend commissioning team meetings held on a periodic basis. Create a meeting agenda for distribution prior to the meeting and document the meetings minutes.
  - c. Ensure and coordinate the participation of the subcontractors in the Commissioning process.
  - d. Track completion of equipment start up and forward start up reports generated by contractor to CxA at least 7 days prior to functional testing.
  - e. Track completion of test and balance and forward test and balance report generated by contractor to CxA at least 7 days prior to functional testing.
  - f. Coordinate the completion of the Pre-functional checklists (PFC) by the Discipline Specific Contractors and submit completed forms to the CxA for approval.
  - g. Review and accept commissioning process test procedures provided by the CxA.
  - h. Coordinate all necessary parties for scheduled functional testing.
  - i. Coordinate access to all commissioned system components as necessary for CxA to witness functional test procedures.
  - j. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.

- k. Review and follow procedures outlined in the Commissioning Plan.
- l. Track completion of resolution of issues recorded in the Issue Log. Coordinate installing contractor's responses and updates to Issue Log.
- m. Integrate and coordinate commissioning process activities with commissioning schedule based upon the construction schedule. Identify other activities that may impede the commissioning process (air barrier testing, TAB, fire alarm testing, etc..)
- n. Coordinate the training of Owner personnel and provide the times and dates of training to the CxA. Provide training agendas prior to training and evaluation forms completed by training participants to the CxA.
- o. Deferred Testing participation.

E. Subcontractors

- 1. Subcontractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
  - a. Attend commissioning kickoff meetings and additional meetings as necessary.
  - b. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
  - c. Complete their related sections on the Pre-functional Checklists (PFC).
  - d. Perform the test procedures laid out in the Functional Test Procedures (FTP) for pretesting prior to final testing witness by the CxA.
  - e. Perform the test procedures laid out in the Functional Test Procedures (FTP) for witness by the CxA.
  - f. Review and follow procedures outlined in the Commissioning Plan.
  - g. Provide requested graphical trends to the CxA for demonstration of system performance and incorporation into the CxA documentation.
  - h. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone data logging equipment that may be used by the CxA.

- i. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.
- j. Review test procedures for equipment installed by factory representatives.
- k. Deferred Testing participation.

F. Equipment Supplier

- 1. The equipment suppliers shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:
  - a. Assist in equipment testing per agreements with Subs.
  - b. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.
  - c. Review test procedures for equipment installed by factory representatives.
  - d. Attend commissioning kickoff meetings and additional meetings as necessary.

1.06 CODES AND STANDARDS

- A. BCA guidelines
- B. ASHRAE commissioning guidelines
- C. ACG guidelines

2 PRODUCTS

2.01 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup and initial checkout and required functional test procedures shall be provided by the Contractor. Two-way radios shall be provided by the Contractor when necessary.
- B. Special equipment, tools, test gas, and instruments required for testing equipment shall be provided by the Contractor.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply:  
Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of  $\pm 0.1^\circ\text{F}$ . Pressure sensors shall have an accuracy of  $\pm 2.0\%$  of the value range being measured (not

full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

### 3 EXECUTION

#### 3.01 COMMISSIONING TEAM:

- A. The members of the commissioning team consist of the Commissioning authority (CxA), the Owner's Representative (OR), the designated representative of the owner's Construction Management firm (CM), the General Contractor commissioning coordinator (GC), the architect and design engineers (AE & EOR), the designated representative of the Mechanical Contractor (MC), the designated representative of the Electrical Contractor (EC), the TAB representative, the designated representative of the Controls Contractor (CC), any other installing discipline contractors or suppliers of equipment. If known, the Owner's building or plant operator/engineer is also a member of the commissioning team.

#### 3.02 COMMISSIONING PLAN:

- A. The CxA will develop the commissioning plan with review and input from the rest of the Commissioning Team.

#### 3.03 COMMISSIONING KICK OFF MEETING:

- A. An initial kick off meeting organized by the General Contractor Commissioning Coordinator (GC) and facilitated by the Commissioning Authority (CxA) during construction where the commissioning process is reviewed with the project commissioning team members.

#### 3.04 COMMISSIONING SCHEDULE:

- A. The GC will be required to maintain a commissioning schedule that is updated periodically during the commissioning process and is presented and discussed at the commissioning meetings.
- B. Include the following typical types of milestone and predecessors:
  - 1. Utilities Available
  - 2. System Readiness (by system)
    - a. Utilities available to equipment (water, power, gas)
    - b. Equipment Startup
    - c. Controls Point to Point

- d. Test and Balancing
    - e. Functional Test Procedures
  - 3. Conflicting construction activities (preventing Cx activities), some examples as follows:
    - a. Fire alarm testing
    - b. Air barrier testing
    - c. Air quality measuring
  - C. The schedule shall be submitted to the CxA for review and discussion during the Commissioning Meetings.
- 3.05 COMMISSIONING MEETINGS:
  - A. Periodic meeting held during construction organized and managed by the GC to plan, scope, coordinate, and schedule future activities and resolve problems with the commissioning team members.
- 3.06 SUBMITTALS:
  - A. Equipment documentation shall be submitted to the CxA from the GC to detail startup procedures.
- 3.07 STARTUPS:
  - A. The CxA may witness startup of selected equipment identified in the Commissioning Plan. Scheduling of these startups shall be incorporated into the Commissioning Schedule.
- 3.08 PRE-FUNCTIONAL CHECKLIST (PFC):
  - A. The CxA will develop the PFCs with review and input from the Commissioning Team. After equipment is installed, the PFCs shall be filled out by the EC, MC, and the CC. The GC shall verify the completion of the forms prior to submitting them to the CxA. The submission of the PFC is an indication that the equipment is ready to begin functional Test Procedures (FTP).
  - B. Contractor will conduct independent start up and testing. Contractor completes manufacturer start up documentation which covers basic component set up, calibration, and functionality which shall be prerequisite to functional test procedures.
  - C. Only field individuals that have direct knowledge and witnessed that a line item task on the PFC was actually performed shall initial or check that item.

**3.09 TEST DOCUMENTATION:****A. TAB report:**

1. Prior to functional testing, certified and approved TAB report shall be submitted to the CxA for review.
2. The CxA may verify the TAB report for verification equipment performance. At the request of the CxA, the contractor will be available on the jobsite and with the same portable measurement instrument used during balancing, start-up and to verify 10% of the report values in the field.

**B. DDC point to point (For BAS, FMS, EPMS)**

1. CC shall submit a point to point checkout report that verifies all the end to end device conditions. Checkout report shall verify all installation of end device, wiring between device and controller and controller software is configured correctly reflected in the software.

**3.10 SITE OBSERVATIONS:**

- A. The CxA will periodically perform site visits, as necessary, to observe component and system installations. Deficiencies will be identified in the Issue Log and discussed at Commissioning Meetings.

**3.11 FUNCTIONAL TEST PROCEDURES (FTPs):**

- A. The CxA develops the FTPs based upon the sequence of operations laid out in the contract documents and approved control submittal and with review and input from the rest of the Commissioning Team.
- B. It is important that the GC, EC, MC, and CC review the FTPs for consistency with the current contract document requirements. Lack of coordination on the FTP may result in retesting and delay the commissioning process.
- C. Once the PFCs have been completed, the GC shall schedule testing with the CxA and Owner at least 7 days in advanced.
- D. The GC shall ensure that the systems have been pretested by the installing contractor according to the approved FTP to ensure that systems are operating properly and to avoid retesting.

**3.12 NON-CONFORMANCE.**

- A. The CxA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be identified on the AL.

- B. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases the deficiency and resolution will be documented on the procedure form.
- C. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.

### 3.13 RETESTING:

- A. If a functional test procedure has been unable to be satisfactorily completed, it will need to be retested.
- B. Once the non-conformance has been resolved, the GC shall schedule test witnessing with the CxA and Owner at least 7 days in advance.
- C. Cost of Retesting.
  - 1. The cost for the subcontractor to retest a pre-functional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the GC.
  - 2. For a deficiency identified, not related to any pre-functional checklist or start-up fault, the following shall apply: The CxA will direct the retesting of the equipment once at no additional cost. However, the Owner may charge the GC for the CxA's time for a second retest.
  - 3. The time for the CxA to direct any retesting required because a specific *pre-functional* checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be deficient, may be charged by the Owner to the GC.

### 3.14 DEFERRED TESTING

- A. Unforeseen Deferred Tests occur if any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the OR. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.
- B. Seasonal Testing occurs if any testing is delayed until the weather conditions are closer to the system's design. During the warranty period, seasonal testing shall be completed as part of this contract. The CxA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the CxA witnessing. Any final adjustments to the O&M manuals and as-builds due to the testing will be made.

END OF SECTION

## SECTION 024119 - SELECTIVE STRUCTURE DEMOLITION

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Demolition and removal of selected portions of building or structure.
  - 2. Demolition and removal of selected site elements.

## 1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

## 1.3 SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate detailed sequence of selective demolition and removal work, with starting and ending dates for each activity, interruption of utility services, use of elevator and stairs, and locations of temporary partitions and means of egress.
- B. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Comply with Division 01 Section "Photographic Documentation." Submit before Work begins.
- C. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
  - 1. Comply with submittal requirements in Division 01 Section "Construction Waste Management and Disposal."

## 1.4 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI A10.6 and NFPA 241.
- D. Predemolition Conference: Conduct conference at Project site.

#### 1.5 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
  - 1. Before selective demolition, Owner will remove the following items:
    - a. Furniture
    - b. Wood shop equipment
    - c. Classroom educational aids (markerboards, etc.)
    - d. General storage items and racking
    - e. Greenhouse & shed
    - f. Materials from within two connex container boxes
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

#### 1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- F. Survey of Existing Conditions: Record existing conditions by use of measured drawings.
  - 1. Comply with requirements specified in Division 01 Section "Photographic Documentation."
- G. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

## 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Arrange to shut off indicated utilities with utility companies.
  - 2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  - 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

### 3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

### 3.4 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  - 4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  - 5. Dispose of demolished items and materials promptly. Comply with requirements in Division 01 Section "Construction Waste Management and Disposal."
- B. Removed and Salvaged Items:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until delivery to Owner.
  - 4. Protect items from damage during transport and storage.
- C. Removed and Reinstalled Items:
  - 1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.

2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  3. Protect items from damage during transport and storage.
  4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

### 3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
1. Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

### 3.6 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

## SECTION 033000 - CAST-IN-PLACE CONCRETE

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. See Division 31 Section "Earth Moving" for drainage fill under slabs-on-grade.

## 1.2 Related sections include the followings:

- A. Section 033170 'Concrete Floor Slab Joints and Fillers'
- B. Section 033700 'Concrete Floor Slabs Curing'
- C. Section 033950 'Penetration Seal and Hardener'

## 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture.
- C. Shop Drawings: For steel reinforcement.

## 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
  - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- C. Preinstallation Conference: Conduct conference at Project site.

## PART 2 - PRODUCTS

## 2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

## 2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

## 2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
  - 1. Portland Cement: ASTM C 150, Type II. Supplement with the following:
    - a. Fly Ash: ASTM C 618, Class C or F.
    - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
  - 2. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag cement.
- B. Normal-Weight Aggregates: ASTM C 33, graded, 1-1/2-inch (38-mm) at slab on grade. 3/4-inch (19-mm) typical nominal maximum coarse-aggregate size.
  - 1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

#### 2.4 VAPOR RETARDERS

- A. Plastic Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

#### 2.5 CURING MATERIALS

- A. Evaporation Retarder: Per Section 033700
- B. Water: Potable.
- C. Clear, Waterborne, Membrane-Forming Curing Compound: Per Section 033700.

#### 2.6 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

#### 2.7 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Proportion normal-weight concrete mixture as follows:
  1. Minimum Compressive Strength: per plans at 28 days.
  2. Maximum Water-Cementitious Materials Ratio: 0.45 for walls and slabs and 0.55 for footings.
  3. Slump Limit: 4 inches (100 mm), 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
  4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

#### 2.8 FABRICATING REINFORCEMENT

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

## 2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information.
  - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

## PART 3 - EXECUTION

### 3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork according to ACI 301 to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Chamfer exterior corners and edges of permanently exposed concrete.

### 3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

### 3.3 VAPOR RETARDERS

- A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
  - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

### 3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

### 3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
  - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

### 3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
  - 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
- C. Cold-Weather Placement: Comply with ACI 306.1.
- D. Hot-Weather Placement: Comply with ACI 301.

### 3.7 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
  - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
  - 1. Apply to concrete surfaces exposed to public view.

- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
  2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
  3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

### 3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in 1 direction.
1. Apply scratch finish to surfaces indicated.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces to receive trowel finish.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

2. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-foot- (3.05-m-) long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 3/16 inch (4.8 mm).
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated, while concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

### 3.9 AGGREGATE BASE COURSE UNDER FLOOR SLAB:

- A. Provide a 6" minimum thick base under floor slabs using crushed, partially crushed, or naturally occurring fractured face granular material from source approved by the Geotechnical Engineer.
- B. Compact lifts to at least 95% of ASTM D-1557-70 maximum dry density. Proof Roll the entire area under slabs before placement of final 6" aggregate base as outlined in geotechnical report.
- C. Placed and compacted aggregate base under the floor slab shall be stable, trimmable, and deflect not more than 1/4" under a fully loaded ready-mix concrete truck.

### 3.10 CONCRETE

- A. General: Use only ready-mix concrete furnished by an established supplier, conforming to ASTM C 94- "Specification for Ready-Mixed Concrete".
- B. Concrete Quality:
1. Concrete shall attain the ultimate strength called for in Structural Notes, and shall be determined by standard 3 and 7 day (type III cement) and 7 and 28 day (type I cement) cylinder tests, ASTM C-31 and C-150.
  2. Slabs on grade: - four (4)" maximum slump.
  3. Conform to the requirements included in the Structural Notes on the Drawings.
- C. Components:
1. Cement: Portland Cement, one brand of uniform color conforming to ASTM C 150 - "Specification for Portland Cement". See Structural Notes.
  2. Aggregate: Conform to ASTM C 33 – "Specification for Concrete Aggregates".
    - a. Fine – Natural sand
    - b. Coarse – Natural gravel size No. 467 or 1½" to No. 4 size. Free from deleterious substances.
  3. Water:
    - a. Clean and free from deleterious substances and shall be potable.
    - b. Where soils in contact with slab have water soluble sulfate exceeding 0.20 percent by weight, limit water to cement ratio to 0.45 and use type 'V' cement.
    - c. Maximum water to cement ratio = 0.49.

- d. If increased workability is required, submit mix design with super-plasticizer admixture to be added at the concrete plant.
4. Admixtures – The Architect must accept all admixtures in writing, prior to use.
  - a. Bonding Agent –
    - 1) “Everbond”, by L&M Construction Chemical, Inc., 14851 Calhoun Road, Omaha, NE 68152, (800) 362-3331, Ph: (402) 453-6600, Fax: (402) 453-0244, em: [lmdeker@aol.com](mailto:lmdeker@aol.com), [www.lmcc.com](http://www.lmcc.com)
    - 2) “Day-Chem Ad Bond (J-40)”, by Dayton Superior Corporation, 4226 Kansas Avenue, Kansas City, KS 66106, (866) 329-8724, Fax: (913) 279-4806, em: [toddfraker@daytonsuperior.com](mailto:toddfraker@daytonsuperior.com), [www.daytonsuperiorchemical.com](http://www.daytonsuperiorchemical.com)

D. Proportioning and Design of Concrete Mixes:

1. Refer to Structural Notes for specific proportions.
2. Prepare design mix for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Architect/Structural Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.
3. Use no fly ash or air entrainment for interior slab on grade.
4. Adjustment to Concrete Mixes: Mix design adjustments requested by Contractor, when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, shall be at no additional cost to Owner. Laboratory test data for revised mix design and strength results shall be submitted to and accepted by Architect before using in work.

3.11 PRE-CONCRETE INSTALLATION CONFERENCE:

- A. A primary objective of this work is to deliver to the Owner at the completion of this project a flat, crack-free concrete floor slab with a hard-burnished finish. Before submitting design mixes, review concrete mix design and examine procedures for ensuring quality of concrete materials.
- B. Before any floor slab concrete is placed, schedule and hold a meeting, to be led by the Architect’s representative, to review the project requirements and the expected end product results. Notify and require representatives of each entity directly concerned with the floor slab to attend, including qualified representatives of the following:
  1. General Contractor’s Superintendent.
  2. Concrete Subcontractor, Concrete Finishing Foreman.
  3. Independent testing agency responsible for concrete design mixes.
  4. Ready-mix concrete producer.
  5. Representatives for -
    - a. Floor Slab Joint Filler Manufacturer (Section 03317)
    - b. Floor Slab Curing Material Manufacturer (Section 03370)
    - c. Penetrating Seal and Hardener Manufacturer (Section 03395)

3.12 PREPARATION

- A. Notify the Architect, and the appropriate material testing agencies at least twenty-four (24) hours before and intended pour.

- B. Make sure no concrete is placed until all reinforcing, steel pipes, conduits, sleeves, hangers and all other work required to be built into concrete is inspected by required testing agencies and approved by local building officials.
- C. Thoroughly moisten aggregate base course under floor slab immediately before pouring slab.

3.13 FLOOR DRAINS, TRENCH DRAINS AND CLEANOUTS

- A. Embed floor drains, trench drains and floor cleanouts into concrete at least twenty-four (24) hours before the floor slab is placed.
  - 1. Where slab slopes to a drain, place and slope concrete for diameter indicated on the Drawings, or a minimum of forty (40)-inch radius around the drain. Steel trowel to hard finish.

3.14 PLACING CONCRETE

- A. Use agitator type trucks and place within 1-1/2 hours after introduction of water. Keep equipment clean and free of dried concrete.
- B. Maximum Allowable Placing temperatures as indicated in ACI-301 and outline below:
  - 1. Hot weather (maximum) 80° F. (If higher, use ACI-305) □
  - 2. Cold weather (minimum) 40° F. (If lower, use ACI-306)
- C. Coat existing concrete to be joined with new concrete with Bonding Agent, where called for in structural drawings, applied in accordance with manufacturer’s instructions.
- D. Concrete Placing, once started, shall be carried on as a continuous operation until placing of section is complete.
  - 1. Convey in a method to insure no separation, segregation or intrusion of foreign matter.
  - 2. Thoroughly consolidate concrete by means of mechanical vibrators.
  - 3. Use screeding equipment that disperses concrete by auger, consolidating and vibrating the concrete with self-leveling, laser-guided screeding heads: Use “Laser Scream” equipment by Somero Enterprises, 82 Fitzgerald Drive, Jaffrey, NH 03452, Ph: (603) 532-5900, or other approved, laser-guided equipment.
- E. Slabs on Grade: Screed slabs to proper elevations without irregularities. Maintain joint edges as indicated on Drawings. Allowable tolerances for finished flat slabs, when measured within twenty-four (24) hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface -

		Flatness FF	Levelness FL
1.	Specified Overall Value (SOV)	SOV:>50	SOV:>40
2.	Minimum Local Value (MLV)	MLV:>35	MLV:>25
3.	In the event the measured Flatness, and/or Levelness is less than that indicated above, do one of the following:		
a.	Remove slabs where measured flatness, or levelness or both, fall below		

the values listed above. Replace with new slab construction conforming with the contract documents.

- b. Where allowed by the Architect, in lieu of removing areas of slabs out of flatness / levelness specification, give a credit to the Owner for non-compliant work in place. Use the following to determine the credit amount for each square foot of non-compliant work –

$$\$3 \left| \frac{\left[ \text{Specified Value} \right]}{\left[ \text{Measured Value} \right]} - 1 \right| = \text{Credit to Owner}$$

- F. Stop slab pours at construction joints as indicated on the drawings. Structural slab stops to be approved by the Structural Engineer.
- G. Do not wet concrete surfaces with water during screeding, initial floating or finishing operations.
1. Where a finishing aid is appropriate, use materials and methods described in Section 03370.

### 3.15 INTERIOR SLAB CONSTRUCTION JOINTS

- A. Make construction joints at each edge of each pour, where shown on the drawings.
- B. Construction Joint:
1. Edges: Do not tool or finish concrete construction joint edges to a radius edge.
  2. Keep joints between adjacent slabs as pours as plain, straight, vertical butt joints, with sharp, square concrete corners to prevent ‘feathering’ of Joint Filler described in Section 03317.
  3. When making the second pour at a construction joint, keep the material of the second pour from accumulating on top of the first pour. If the newly placed concrete hardens on top of the previously placed slab, remove it by grinding to get a smooth and level transition with clean, flush and straight edges on both slabs so a clean Joint Filler installation is possible.
- C. Construction Joint Reinforcing: Discontinue slab reinforcing and use greased or sleeved dowels at each edge of each pour, as indicated on the drawings.

### 3.16 FINISHING INTERIOR CONCRETE SLAB:

- A. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by power-driven trowels. Continue troweling passes until surface is free of trowel marks, uniform in texture and appearance, with a hard-burnished, dense and glossy surface.
- B. Do not finish bleed water, or surface contaminants (wind-blown soil, jobsite trash, fuel or lubricants) into the surface of the slabs.

### 3.17 SHRINKAGE CONTROL JOINTS:

- A. Cut Shrinkage Control Joints into the slab in accordance with Section 03317, “Concrete Shrinkage Control Joints and Fillers.”

### 3.18 CONCRETE SLAB CURING:

- A. Clean slab after cutting shrinkage joints, then cure the slab in accordance with Section 03370 “Concrete Floor Slab Curing”.

### 3.19 MISCELLANEOUS

- A. Use concrete or non-shrink grout to fill around pipes, ducts and conduit passing through floors and walls, and around all steel guard posts.

### 3.20 PROTECTION OF CONCRETE FLOOR SLAB:

- A. Take the following measures to protect the floor slab from stains, marks, scuffing, scratching or similar damage by construction equipment during construction.
  - 1. Wrap or “diaper” all motorized and hydraulic equipment to prevent fluid leaks or spills onto concrete, and equip rubber tires with covers as follows:
    - a. Diaper Material: Use “Enviro-Shields”, replaceable absorbent pads, specifically tailored to fit under the equipment, including drive-motors and other protruding machinery.
    - b. Tire Boots: Equip rubber-tired vehicles with gray colored tires, or suitable tire covers made from nylon fabric, tailored to wrap around the tire, secured by drawstrings and velcro attachments.
    - c. Boot and Diaper Source: Use products marketed by the following, (or other approved), source:

R & R TIRE SURFACE PROTECTORS, INC.  
2701 Killdeer Drive  
Fort Collins, Colorado 80526  
Ph: (970) 226-4082  
Fx: (970) 226-4991  
Em: [info@rrtirecovers.com](mailto:info@rrtirecovers.com)

- B. Allow no vehicles to park on the floor slab. If it is necessary for a vehicle to stop while on the slab to permit loading, unloading or other work to progress, then have a clean absorbent cloth pre-positioned at the vehicle stopping place, keeping it under the vehicle at all times.
- C. Do not use a pipe-cutting machine on the slab, or cut pipe with tools or equipment using liquid coolants or lubricants.
- D. Place no steel parts directly on the slab. Support stored steel on dry wood crib-supports to avoid rust stain on slab.

### 3.21 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
    - a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
  - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

### 3.22 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
  - 1. Testing Services: Tests shall be performed according to ACI 301.

END OF SECTION 033000

## SECTION 055213 - PIPE AND TUBE RAILINGS

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Steel pipe railings.

## 1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails:

- a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
- b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
- c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

- a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
- b. Infill load and other loads need not be assumed to act concurrently.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

## 1.3 SUBMITTALS

## A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

## PART 2 - PRODUCTS

### 2.1 METALS, GENERAL

- A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

### 2.2 STEEL AND IRON

- A. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

### 2.3 MISCELLANEOUS MATERIALS

- A. Fasteners: Provide the following:
  - 1. Stainless-Steel Railings: Type 304 stainless-steel fasteners.
- B. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- D. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Shop Primer for Galvanized Steel: Cementitious galvanized metal primer complying with MPI#26.
- G. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
- H. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.
- I. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

### 2.4 FABRICATION

- A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

- B. Form work true to line and level with accurate angles and surfaces.
- C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove flux immediately.
  - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- D. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
- E. Form changes in direction by bending or by inserting prefabricated elbow fittings.
- F. Bend members in jigs to produce uniform curvature without buckling or otherwise deforming exposed surfaces.
- G. Close exposed ends of railing members with prefabricated end fittings.
- H. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.
- I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
  - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers to transfer loads through wall finishes.

## 2.5 STEEL AND IRON FINISHES

- A. Galvanized Railings:
  - 1. Hot-dip galvanize exterior steel and iron railings, including hardware, after fabrication.
- B. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
- E. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and

Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
  - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
  - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).
- B. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- C. Anchor posts in concrete by inserting into preset metal pipe sleeves or formed or core-drilled holes and grouting annular space.
- D. Anchor railing ends at walls with round flanges anchored to wall construction.
- E. Attach railings with wall brackets, except where end flanges are used. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
- F. Secure wall brackets and railing end flanges to building construction as follows:
  - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
  - 2. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

END OF SECTION 055213

## SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Wood blocking and nailers.
  - 2. Plywood backing panels.
- B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
  - 1. Power-driven fasteners.

## PART 2 - PRODUCTS

## 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. Provide dressed lumber, S4S, unless otherwise indicated.

## 2.2 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Utility shelving.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.
- C. Blocking: Provide solid wood blocking/backing where required by drawings and at the following locations:
  - 1. Alarms
  - 2. Artwork
  - 3. Blinds, shades

4. Casework
5. Dispensers
6. Door hold open devices
7. Door stops
8. Electrical framing
9. Mounted shop equipment
10. Fire extinguishers
11. Grab bars
12. Gym equipment
13. Hand rails
14. Hose bibs
15. Kitchen / Restroom sinks
16. Magnetic / Manual door stops
17. Marker and tack boards
18. Mirrors
19. Projection equipment
20. Shelving
21. Signage
22. Speakers
23. Toilet partitions
24. Video monitors
25. Whiteboards

### 2.3 PLYWOOD BACKING PANELS

- A. Backing Panels at Utility Shelving: DOC PS 1, Exposure 1, C-D Plugged in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

### 2.4 FASTENERS

- A. General: Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Power-Driven Fasteners: NES NER-272.
- C. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Do not splice structural members between supports, unless otherwise indicated.
- D. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- E. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
  - 3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's Uniform Building Code.
  - 4. Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code.
  - 5. Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code.
  - 6. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
  - 7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code.

### 3.2 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

## SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Plastic-laminate cabinets and cubbies.
- B. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips unless concealed within other construction before woodwork installation.

## 1.2 SUBMITTALS

- A. Product Data: For cabinet hardware and accessories, and finishing materials and processes.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- C. Samples:
  - 1. Plastic-laminates, for each type, color, pattern, and surface finish.
- D. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

## 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of woodwork.
- B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards."
  - 1. Provide AWI Quality Certification Program labels and certificates for woodwork, including installation.

## 1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

## PART 2 - PRODUCTS

### 2.1 WOODWORK FABRICATORS

- A. Fabricators: Provide interior architectural woodwork by a qualified fabricator with a minimum of five (5) years of experience with cabinetry fabrication.

### 2.2 MATERIALS

- A. Wood Products:
  - 1. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
- B. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
- C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

### 2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural woodwork, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."
- B. Hospital grade overlay hinges required. RPC 374-26D or equal.
- C. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter, 2-1/2 inches deep.

### 2.4 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

### 2.5 FABRICATION

- A. General: Complete fabrication to maximum extent possible before shipment to Project site. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting. Provide "T" molding on all exposed edges of cabinets, cubbies and/or other casework.
  - 1. Interior Woodwork Grade: Custom.
  - 2. Shop cut openings to maximum extent possible. Sand edges of cutouts to remove splinters and burrs. Seal edges of openings in countertops with a coat of varnish.
- B. Plastic-Laminate Cabinets and Cubbies:

1. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate as follows:
  - a. Horizontal Surfaces Other Than Tops: Grade HGS.
  - b. Postformed Surfaces: Grade.
  - c. Vertical Surfaces: Grade HGS.
  - d. Edges: "T" Mold
2. Materials for Semiexposed Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS
3. Colors, Patterns, and Finishes: As selected by Architect from Manufacturer's full range.
4. The shell and horizontal members of cubbies shall be constructed of  $\frac{3}{4}$ " MDO.
5. Where shelves exceed 24" unsupported span, fabricate with 1" MDO.
6. Vertical dividers shall be constructed of  $\frac{1}{2}$ " MDO.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas. Examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.
- B. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- C. Install woodwork level, plumb, true, and straight to a tolerance of 1/8 inch in 96 inches. Shim as required with concealed shims.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.
  1. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips and No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop. Calk space between backsplash and wall with interior grade sealant.

END OF SECTION 064023

## SECTION 072100 - THERMAL INSULATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Cavity-wall insulation.
  - 2. Concealed building insulation.
  - 3. Sound attenuation insulation.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Plenum Rating: Provide glass-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.
  - 1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm (13-m/s) air velocity.
  - 2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with *Chaetomium globosum* on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units for each type of exposed insulation indicated.
- C. Product test reports.
- D. Research/Evaluation Reports: For foam-plastic insulation.

#### 1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84 for surface-burning characteristics and other methods indicated with product, by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  2. Products: Subject to compliance with requirements, provide one of the products specified.
  3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 GLASS-FIBER BLANKET INSULATION

- A. Available Manufacturers:
1. CertainTeed Corporation.
  2. Guardian Fiberglass, Inc.
  3. Johns Manville.
  4. Knauf Fiber Glass.
  5. Owens Corning.
- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- C. Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on 1 face.
- D. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:
1. 3-1/2 inches (89 mm) thick with a thermal resistance of 13 deg F x h x sq. ft./Btu at 75 deg F (2.3 K x sq. m/W at 24 deg C).
  2. 5-1/2 inches (140 mm) thick with a thermal resistance of 19 deg F x h x sq. ft./Btu at 75 deg F (3.3 K x sq. m/W at 24 deg C).
  3. 6-1/2 inches (165 mm) thick with a thermal resistance of 21 deg F x h x sq. ft./Btu at 75 deg F (3.7 K x sq. m/W at 24 deg C).

### 2.3 AUXILIARY INSULATING MATERIALS

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturers for sealing joints and penetrations in vapor-retarder facings.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

### 2.4 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate formed from perforated galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square, welded to projecting copper-coated steel spindle 0.105 inch (2.67 mm) in diameter and of length capable of holding insulation of thickness indicated securely in position with 1-1/2-inch- (38-mm-) square or diameter self-locking washers complying with the following requirements:
  - 1. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm) thick galvanized steel sheet, with beveled edge for increased stiffness.
  - 2. Where anchors are located in ceiling plenums, protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap.
- B. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

### 3.2 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Set vapor-retarder-faced units with vapor retarder to warm-in-winter side of construction, unless otherwise indicated.
  - 1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

### 3.3 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- A. Install 3-inch- (76-mm-) thick, unfaced glass-fiber blanket insulation over suspended ceilings at partitions in a width that extends insulation 48 inches (1219 mm) on either side of partition.

### 3.4 INSTALLATION OF VAPOR RETARDERS

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches (400 mm) o.c.
- C. Before installing vapor retarder, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
- D. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.
- E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- F. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

END OF SECTION 072100

## SECTION 079200 - JOINT SEALANTS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Silicone joint sealants.
  - 2. Urethane joint sealants.
  - 3. Latex joint sealants.
  - 4. Preformed joint sealants.
  - 5. Acoustical joint sealants.

## 1.2 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

## 1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
  - 4. Joint-sealant color.
- C. Product test reports.
- D. Preconstruction compatibility and adhesion test reports.
- E. Field-adhesion test reports.
- F. Warranties.

## 1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

## 1.5 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
  - 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- B. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

### 2.2 SILICONE JOINT SEALANTS

- A. Mildew-Resistant, Neutral-Curing Silicone Joint Sealant: ASTM C 920.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Building Systems.
    - b. Dow Corning Corporation.
    - c. GE Advanced Materials - Silicones.
    - d. Pecora Corporation.
    - e. Polymeric Systems, Inc.
    - f. Sika Corporation; Construction Products Division.

- g. Tremco Incorporated.
2. Type: Single component (S).
  3. Grade: Pourable (P) or nonsag (NS).
  4. Class: 100/50.
  5. Uses Related to Exposure: Traffic (T) or Nontraffic (NT).

### 2.3 URETHANE JOINT SEALANTS

#### A. Urethane Joint Sealant: ASTM C 920.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. BASF Building Systems.
  - b. Bostik, Inc.
  - c. Lyntal, International, Inc.
  - d. May National Associates, Inc.
  - e. Pacific Polymers International, Inc.
  - f. Pecora Corporation.
  - g. Polymeric Systems, Inc.
  - h. Sika Corporation; Construction Products Division.
  - i. Tremco Incorporated.
2. Type: Single component (S) or multicomponent (M).
3. Grade: Pourable (P) or nonsag (NS).
4. Class: 100/50.
5. Uses Related to Exposure: Traffic (T) or Nontraffic (NT).

### 2.4 LATEX JOINT SEALANTS

#### A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. BASF Building Systems.
  - b. Bostik, Inc.
  - c. May National Associates, Inc.
  - d. Pecora Corporation.
  - e. Schnee-Morehead, Inc.
  - f. Tremco Incorporated.

## 2.5 PREFORMED JOINT SEALANTS

- A. Preformed Foam Joint Sealant [PS-~~<#>~~]: Manufacturer's standard preformed, precompressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. (160 kg/cu. m) and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dayton Superior Specialty Chemicals.
    - b. EMSEAL Joint Systems, Ltd.
    - c. Sandell Manufacturing Co.
    - d. Schul International, Inc.
    - e. Willseal USA, LLC.

## 2.6 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Joint Sealant [AS-~~<#>~~]: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Pecora Corporation.
    - b. USG Corporation.

## 2.7 JOINT SEALANT BACKING

- A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

## 2.8 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
  - 1. Remove laitance and form-release agents from concrete.
  - 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.2 INSTALLATION

- A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
  2. Completely fill recesses in each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
  2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
- F. Acoustical Sealant Installation: Comply with ASTM C 919 and with manufacturer's written recommendations.
- G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.3 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
    - a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
    - b. Perform 1 test for each 1000 feet (300 m) of joint length thereafter or 1 test per each floor per elevation.
  2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### 3.4 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
1. Joint Locations:

- a. Isolation and contraction joints in cast-in-place concrete slabs.
    - b. Other joints as indicated.
  2. Joint Sealant: Urethane.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
  1. Joint Locations:
    - a. Construction joints in cast-in-place concrete.
    - b. Control and expansion joints in unit masonry.
    - c. Joints between metal panels.
    - d. Joints between different materials listed above.
    - e. Perimeter joints between materials listed above and frames of doors, windows and louvers.
    - f. Control and expansion joints in ceilings and other overhead surfaces.
    - g. Other joints as indicated.
  2. Joint Sealant: Silicone.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
  1. Joint Locations:
    - a. Isolation joints in cast-in-place concrete slabs.
    - b. Other joints as indicated.
  2. Joint Sealant: Urethane.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
  1. Joint Locations:
    - a. Control and expansion joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints of exterior openings where indicated.
    - c. Vertical joints on exposed surfaces of interior unit masonry walls.
    - d. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
    - e. Other joints as indicated.
  2. Joint Sealant: Latex.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
  1. Joint Sealant Location:

- a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - b. Other joints as indicated.
  2. Joint Sealant: Silicone.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Location:
    - a. Acoustical joints where indicated.
    - b. Other joints as indicated.
  2. Joint Sealant: Acoustical.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 079200

## SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Standard hollow metal doors and frames.

## 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required.
- E. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

## 1.3 QUALITY ASSURANCE

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.
  1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by: Curries Company; an Assa Abloy Group company.

## 2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS, Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS, Type B.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- G. Mineral-Fiber Insulation: ASTM C 665, Type I.
- H. Glazing: Division 08 Section "Glazing."
- I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat.

## 2.3 STANDARD HOLLOW METAL DOORS

- A. General: Comply with ANSI/SDI A250.8.
  - 1. Design: Flush panel.
  - 2. Core Construction: Manufacturer's standard fiberglass insulation and vertical steel-stiffener core.
    - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
    - b. Thermal-Rated (Insulated) Doors: R-value of not less than 6.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
  - 3. Vertical Edges for Single-Acting Doors: Manufacturer's standard.
  - 4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
  - 5. Tolerances: SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).
2. Gauge: 16-gauge

C. Hardware Reinforcement: ANSI/SDI A250.6.

## 2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8.

B. Interior Frames: Fabricated from cold-rolled steel sheet.

1. Fabricate frames with mitered corners.
2. Fabricate frames as knocked down or face welded unless otherwise indicated.
3. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.

C. Hardware Reinforcement: ANSI/SDI A250.6.

## 2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
2. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

## 2.6 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, same material as door face sheet.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, same material as frames.

## 2.7 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- (6.4-mm-thick by 25.4-mm-) wide steel.

## 2.8 FABRICATION

- A. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- B. Hollow Metal Doors:
  - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors. Seal joints in top edges of doors against water penetration.
  - 2. Glazed Lites: Factory cut openings in doors.
- C. Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
  - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
  - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
  - 4. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
      - 1) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
      - 2) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
    - b. Compression Type: Not less than two anchors in each jamb.
    - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
  - 5. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers.
    - a. Single-Door Frames: Three door silencers.
    - b. Double-Door Frames: Two door silencers.
- D. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
  - 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
  - 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
  - 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
  - 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 electrical Sections.

## 2.9 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
  - 1. Shop Primer: ANSI/SDI A250.10.
- B. Factory-Applied Paint Finish: ANSI/SDI A250.3.
  - 1. Color and Gloss: To match existing.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Hollow Metal Frames: Comply with ANSI/SDI A250.11.
  - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. At fire-protection-rated openings, install frames according to NFPA 80.
    - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - c. Install frames with removable glazing stops located on secure side of opening.
    - d. Install door silencers in frames before grouting.
    - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    - g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
  - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
    - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
  - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
  - 4. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  - 5. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.

6. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
  - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
  - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- B. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
  1. Non-Fire-Rated Standard Steel Doors:
    - a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
  2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
  1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

### 3.2 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- C. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

## SECTION 083613 - SECTIONAL DOORS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes manually and electrically operated sectional doors.

## 1.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Sectional doors shall meet performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
- B. Delegated Design: Design sectional doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Air Infiltration: Maximum rate not more than indicated when tested according to ASTM E 283 or DASMA 105]
  - 1. Air Infiltration: Maximum rate of 0.08 cfm/sq. ft. (0.406 L/s per sq. m).
- D. Windborne-Debris-Impact-Resistance Performance: Provide glazed sectional doors, and sectional doors, including glazed sections, that pass large-missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and ASTM E 1996.
- E. Seismic Performance: Sectional doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

## 1.3 SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Delegated-Design Submittal: For sectional doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Seismic Qualification Certificates: For sectional doors, accessories, and components, from manufacturer.
- F. Maintenance data.

- G. Warranties: Sample of special warranties.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Standard for Sectional Doors: Fabricate sectional doors to comply with DASMA 102 unless otherwise indicated.

#### 1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 ALUMINUM DOOR SECTIONS

- A. Sections: Construct door sections with stiles and rails formed from extruded-aluminum shapes. Fabricate sections with stile and rail dimensions and profiles shown on Drawings. Join stiles and rails by welding or with concealed aluminum or nonmagnetic stainless-steel through bolts, full height of door section. Form meeting rails to provide a weathertight-seal joint.
  - 1. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Ensure that reinforcement does not obstruct vision lites.
  - 2. Provide reinforcement for hardware attachment.
- B. Full-Vision Sections: Manufacturer's standard, tubular, aluminum-framed section fully glazed with 6-mm-thick, clear acrylic glazing set in vinyl, rubber, or neoprene glazing channel and with removable extruded-vinyl or aluminum stops.

#### 2.2 TRANSLUCENT DOOR SECTIONS

- A. Construct door sections of extruded-aluminum stiles and rails to provide door sections at least 1-3/4 inches (44 mm) deep. Fabricate units with overlapped or interlocked weathertight-seal

joints at meeting rails. Reinforce or truss each section as required for strength and rigidity. Provide reinforcement for hardware attachment.

### 2.3 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances shown on Drawings. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track spaced 2 inches (51 mm) apart for door-drop safety device. Slope tracks at proper angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.
- B. Track Reinforcement and Supports: Galvanized-steel track reinforcement and support members. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.
- C. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.
- D. Windows: Manufacturer's standard window units of type and size indicated and in arrangement shown. Provide removable stops of same material as door-section frames.

### 2.4 HARDWARE

- A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Heavy-duty, galvanized-steel hinges at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails.
- C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Provide 3-inch- (76-mm-) diameter roller tires for 3-inch- (76-mm-) wide track and 2-inch- (51-mm-) diameter roller tires for 2-inch- (51-mm-) wide track.
- D. Push/Pull Handles: For push-up or emergency-operated doors, provide galvanized-steel lifting handles on each side of door.

### 2.5 LOCKING DEVICES

- A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only. To be provided at industrial function locations

- B. Locking Device Assembly at shop/classroom doors: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
  - 1. Lock Cylinders: Provide cylinders standard with manufacturer and keyed to building keying system.

## 2.6 COUNTERBALANCE MECHANISM

- A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.
- B. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.
- C. Cables: Galvanized-steel lifting cables.
- D. Cable Safety Device: Include, on each side-edge of door, a device designed to automatically stop door if either lifting cable breaks.
- E. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
- F. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

## 2.7 MANUAL DOOR OPERATORS

- A. Equip door with manufacturer's recommended manual door operator unless another type of door operator is indicated.
- B. Push-up Operation: Lift handles and pull rope for raising and lowering doors, with counterbalance mechanism designed so that required lift or pull for door operation does not exceed 25 lbf (111 N).

## 2.8 DOOR ASSEMBLY (ALUMINUM/GLAZED DOORS)

- A. Full-Vision Aluminum Sectional Door: Sectional door formed with hinged sections.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Amarr Garage Doors.
    - b. Arm-R-Lite.
    - c. C.H.I. Overhead Doors.

- d. Clopay Building Products; a Griffon company.
  - e. Fimbel Architectural Door Specialties.
  - f. General American Door Company.
  - g. Haas Door; a Nofziger company.
  - h. Martin Door Manufacturing.
  - i. Overhead Door Corporation.
  - j. Raynor.
  - k. Rite-Hite Corporation.
  - l. Wayne-Dalton Corp.
  - m. Windsor Republic Doors.
- B. Operation Cycles: Not less than 20,000.
- C. Aluminum Sections: Full vision.
- D. Track Configuration: Standard-lift track.
- E. Weatherseals: Fitted to bottom, top and around entire perimeter of door.
- F. Windows: Approximately 24 by 11 inches (610 by 279 mm), with square corners, and spaced apart the approximate distance as indicated on Drawings; installed with insulated glazing of tinted float glass as described in Division 8 "Glazing"..
- G. Locking Devices: Equip door with locking device assembly.
- 1. Locking Device Assembly: Single-jamb side, locking bars, operable from inside and outside, with cylinders.
- H. Manual Door Operator: Chain-hoist operator.
- I. Door Finish:
- 1. Aluminum Finish: Anodized to match adjacent storefront system.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Tracks: Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment. Repair galvanized coating on tracks according to ASTM A 780.
- C. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion. Adjust doors and seals to provide weathertight fit around entire perimeter.

3.2 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

## SECTION 087100 - DOOR HARDWARE

## PART 1 - GENERAL

NOTE: ALL DOOR HARDWARE & KEYING TO BE COORDINATED WITH BEAVERTON SCHOOL DISTRICT

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Commercial door hardware.
  - 2. Cylinders for doors specified in other Sections.
  - 3. Electrified door hardware.
- B. See Division 08 door sections for astragals and door silencers.

## 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Details of electrified door hardware, including wiring diagrams.
- C. Samples: For each exposed finish.
- D. Product certificates and/or test reports.
- E. Other Action Submittals:
  - 1. Door Hardware Sets: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as procedures and diagrams.
    - a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
    - b. Content: Include the following information:
      - 1) Identification number, location, hand, fire rating, and material of each door and frame.
      - 2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
      - 3) Complete designations of every item required for each door or opening including name and manufacturer.
      - 4) Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
  - 2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks.

### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.
  - 1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
- B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
- C. Source Limitations: Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- D. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver keys to Owner by registered mail or overnight package service.

### 1.5 COORDINATION

- A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

### 1.6 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: Three years from date of Substantial Completion, except as follows:
    - a. Electromagnetic Locks: Five years from date of Substantial Completion.
    - b. Exit Devices: Two years from date of Substantial Completion.
    - c. Manual Closers: 10 years from date of Substantial Completion.
    - d. Concealed Floor Closers: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in door and frame schedule within drawings.
  - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:
  - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.
  - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

### 2.2 HINGES, GENERAL

- A. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- B. Hinge Base Metal: Unless otherwise indicated, provide the following:
  - 1. Exterior Hinges: Stainless steel, with stainless-steel pin.
  - 2. Interior Hinges: Stainless steel, with stainless-steel pin.
- C. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors.
- D. Fasteners: Comply with the following:
  - 1. Screws: Phillips flat-head; machine screws (drilled and tapped holes) for metal doors and wood screws for wood doors and frames. Finish screw heads to match surface of hinges.

### 2.3 HINGES

- A. Butts and Hinges: BHMA A156.1.
- B. Template Hinge Dimensions: BHMA A156.7.
- C. Interior hinges: Ives HW 4.5" x 4.5" NRP, or equal
- D. Exterior hinges: Ives HW 5.5" x 4.5", or equal
- E. Swing movement: All hinges to provide 180 degree swing

## 2.4 LOCKS AND LATCHES

- A. Accessibility Requirements: Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
- B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- C. Electrified Locking Devices: BHMA A156.25.
- D. Lock Trim:
  - 1. Levers: Lock trim levers to comply with ANSI A117.1. Architect to select from manufacturer's full range.
  - 2. Dummy Trim: Match lever lock trim and escutcheons.
- E. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors.
- F. Backset: 2-3/4 inches, unless otherwise indicated.
- G. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set.
- H. Lockset: Schlage VandLGard, interchangeable core
- I. Electronic Locks:
  - 1. Strikes: Von Duprin 6000 series
  - 2. Latches: Von Duprin QEL

## 2.5 EXIT DEVICES

- A. Exit Devices: BHMA A156.3, Grade 1.
- B. Accessibility Requirements: Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
- C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- E. Outside Trim: Lever; material and finish to match locksets, unless otherwise indicated.
  - 1. Match design for locksets and latchsets, unless otherwise indicated.
- F. Panic Bars: Von Duprin EL 99 or XP99 Series

## 2.6 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference into master key system.
  - 1. Keying System: Match existing school system or BSD standards. Confirm existing prior to ordering.
    - a. BSD Standard: Everest Keying System
    - b. Update existing doors for new function and keying
- B. Keys: Nickel silver; permanently inscribed with a visual key control number and including the notation "DO NOT DUPLICATE."
  - 1. Quantity: In addition to one extra key blank for each lock, provide three cylinder change keys and five master keys.

## 2.7 CLOSERS

- A. Accessibility Requirements: Comply with the following maximum opening-force requirements:
  - 1. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
- B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.
- C. Hold-Open Closers/Detectors: Coordinate and interface integral smoke detector and closer device with fire alarm system.
- D. Flush Floor Plates: Provide finish cover plates for floor closers unless thresholds are indicated. Match door hardware finish, unless otherwise indicated.
- E. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
- F. Surface Closers:
  - 1. Inward opening: LCN 4010
  - 2. Outward opening: LCN 4111

## 2.8 WALL STOPS & SILENCERS

- A. Stops and Bumpers: BHMA 626 finish, Ives, or equal.
  - 1. Provide solid wood blocking at all wall stop locations
- B. Silencers for Door Frames: Ives, or equal

## 2.9 DOOR GASKETING

- A. Standard: BHMA A156.22 NGP, Pemko, or equal.

## 2.10 THRESHOLDS

- A. Standard: ANSI/BHMA A156.21. NGP, Pemko, or equal
- B. Accessibility Requirements: Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
- C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch high.
- D. Finish: clear anodized finish, BHMA 628
- E. Seal: provide neoprene or silicon foot seals, 1" wider than frame depth.

## 2.11 FABRICATION

- A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
- B. Fasteners: Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
  - 1. Comply with NFPA 80 for fasteners of door hardware in fire-rated applications.
- C. Finishes: BHMA A156.18, as indicated in door hardware sets.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Steel Doors and Frames: Comply with DHI A115 Series. Drill and tap doors and frames for surface-applied door hardware according to ANSI A250.6.
- B. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."

- C. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.
  - 1. Configuration: Provide one power supply for each door opening.
  - 2. Configuration: Provide the least number of power supplies required to adequately serve doors with electrified door hardware.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- F. 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. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- G. Blocking: Provide solid wood blocking at all wall mounted hardware locations.

END OF SECTION 087100

## SECTION 092216 - NON-STRUCTURAL METAL FRAMING

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes non-load-bearing steel framing members for the following applications:
  - 1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
  - 2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

## 1.2 SUBMITTALS

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

## 1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. Sound Transmission Characteristics: For STC-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

## PART 2 - PRODUCTS

## 2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
  - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
  - 2. Protective Coating: Manufacturer's standard corrosion-resistant zinc coating, unless otherwise indicated.

## 2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch diameter wire, or double strand of 0.0475-inch diameter wire.
- B. Hanger Attachments to Concrete:

1. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch wide flanges.
  1. Depth: As indicated on Drawings.
- F. Furring Channels (Furring Members):
  1. Cold-Rolled Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch wide flanges, 3/4 inch deep.
  2. Steel Studs: ASTM C 645.
    - a. Minimum Base-Metal Thickness: As indicated on Drawings.
    - b. Depth: As indicated on Drawings.
  3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
    - a. Minimum Base Metal Thickness: As indicated on Drawings.

### 2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
  1. Minimum Base-Metal Thickness: As indicated on Drawings.
- B. Slip-Type Head Joints: Where indicated, provide one of the following:
  1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
  2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
  3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- C. Flat Strap and Backing Plate: Not permitted. Provide solid wood blocking/backing where required by drawings and as noted in Section 061053.

- D. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch wide flanges.
  - 1. Depth: As indicated on Drawings.
  - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch thick, galvanized steel.
- E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Minimum Base Metal Thickness: 0.0179 inch.
  - 2. Depth: As indicated on Drawings.
- F. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch wide flanges.
  - 1. Depth: As indicated on Drawings.
  - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch.
  - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch diameter wire, or double strand of 0.0475-inch diameter wire.

## 2.4 AUXILIARY MATERIALS

- A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
  - 1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
  - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
  - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

### 3.2 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to

terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb, unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- C. Direct Furring:
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- D. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 092216

## SECTION 092900 - GYPSUM BOARD

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:

1. Interior gypsum board.

## 1.2 SUBMITTALS

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

## 1.3 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

## PART 2 - PRODUCTS

## 2.1 INTERIOR GYPSUM BOARD

- A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. American Gypsum Co.
    - b. G-P Gypsum.
    - c. National Gypsum Company.
    - d. USG Corporation.
- B. Regular Type:
1. Thickness: 5/8 inch.
  2. Long Edges: Tapered.

- C. Type X:
  - 1. Thickness: 5/8 inch.
  - 2. Long Edges: Tapered.
- D. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
  - 1. Thickness: 5/8 inch.
  - 2. Long Edges: Tapered.
- E. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
  - 1. Core: 5/8 inch, Type X.
  - 2. Long Edges: Tapered.

## 2.2 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
  - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
  - 2. Shapes:
    - a. Cornerbead.
    - b. L-Bead: L-shaped; exposed long flange receives joint compound.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Fry Reglet Corp.
    - b. Gordon, Inc.
    - c. Pittcon Industries.
  - 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 Alloy 6063-T5.
  - 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

## 2.3 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  - 1. Interior Gypsum Wallboard: Paper.

- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
  - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
  - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

## 2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
  - 1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
- D. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  - 1. Use screw complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

## PART 3 - EXECUTION

### 3.1 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

### 3.2 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
  - 1. Regular Type: As indicated on Drawings.
  - 2. Type X: As indicated on Drawings.
  - 3. Flexible Type: As indicated on Drawings. Apply in double layer at curved assemblies.
  - 4. Ceiling Type: As indicated on Drawings.
  - 5. Moisture- and Mold-Resistant Type: As indicated on Drawings.

### 3.3 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners.
  - 2. L-Bead: Use where indicated.

### 3.4 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in other Division 09 Sections.

### 3.5 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

## SECTION 095113 - ACOUSTICAL PANEL CEILINGS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes acoustical panels and exposed suspension systems for ceilings.

## 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: Drawn to scale and coordinating acoustical panel ceiling installation with hanger attachment to building structure and ceiling mounted items:
- C. Samples: For each exposed finish.
- D. Product test reports.
- E. Research/evaluation reports.
- F. Maintenance data.

## 1.3 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory or an NVLAP-accredited laboratory.
- B. Fire-Test-Response Characteristics:
  - 1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
    - a. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 2. Surface-Burning Characteristics: Acoustical panels complying with ASTM E 1264 for Class A materials, when tested per ASTM E 84.
    - a. Smoke-Developed Index: 450 or less.
- C. Seismic Standard: Comply with the following:
  - 1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.

2. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."
- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Preinstallation Conference: Conduct conference at Project site.
- 1.4 EXTRA MATERIALS
- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Acoustical Ceiling Panels: Full-size panels equal to 5.0 percent of quantity installed.
  2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.

## PART 2 - PRODUCTS

### 2.1 ACOUSTICAL PANEL CEILINGS, GENERAL

- A. Acoustical Panel Standard: Comply with ASTM E 1264.
- B. Metal Suspension System Standard: Comply with ASTM C 635.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
- D. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
1. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.
- E. Seismic perimeter stabilizer bars, seismic struts, and seismic clips.
- F. Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements;

formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

## 2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

- A. Basis-of-Design Product: Provide the following or comparable product when approved by architect and owner.
1. Manufacturer: Armstrong
  2. Panel: School Zone Fine Fissured 1714
  3. Edge: 9/16" Tegular
  4. Panel dimensions: 24 inches by 48 inches
  5. Thickness: 3/4"
  6. Color: White

## 2.3 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

- A. Basis-of-Design Product: Provide the following or comparable product when approved by architect and owner.
1. Manufacturer: Armstrong
  2. Profile width: 1"
  3. Color: White
- B. Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished metal caps on flanges.
1. Structural Classification: Heavy-duty system.
  2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
  3. Seismic Clips: Install using manufacturer's standard seismic restraint clip system
  4. Cap Material: Steel or aluminum cold-rolled sheet.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders.
- C. Suspend ceiling hangers from building's structural members, plumb and free from contact with insulation or other objects within ceiling plenum. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally

effective means. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers, use trapezes or equivalent devices. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

END OF SECTION 095113

## SECTION 096513 - RESILIENT BASE AND ACCESSORIES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Resilient base.
  - 2. Resilient molding accessories.

## 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

## 1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

## 1.4 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
- C. Install resilient products after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

## 2.1 RESILIENT BASE

- A. Resilient Base:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Johnsonite, Roppe or Flexco to match existing base conditions.

- B. Resilient Base Standard: ASTM F 1861.
  - 1. Material Requirement: Type TS (rubber, vulcanized thermoset).
  - 2. Manufacturing Method: Group I (solid, homogeneous).
  - 3. Style: Cove (base with toe).
- C. Minimum Thickness: 0.125 inch.
- D. Height: As indicated on Drawings.
- E. Lengths: Coils in manufacturer's standard length
- F. Outside Corners: Premolded corners are not allowed.
- G. Inside Corners: Job formed. Premolded corners are not allowed.
- H. Finish: Matte.
- I. Colors and Patterns: Match existing

## 2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
  - 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
    - a. Cove Base Adhesives: Not more than 50 g/L.
    - b. Rubber Floor Adhesives: Not more than 60 g/L.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Accessories: Prepare according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
  - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.

4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
  - a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are same temperature as the space where they are to be installed.
  1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

### 3.2 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.

### 3.3 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Cover resilient products until Substantial Completion.

END OF SECTION 096513

## SECTION 099123 - INTERIOR PAINTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following interior substrates:
  - 1. Galvanized metal.
  - 2. Gypsum board.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each finish and for each color and texture required.
- C. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

#### 1.3 QUALITY ASSURANCE

- A. MPI Standards:
  - 1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
  - 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

#### 1.4 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
  - 1. Quantity: Furnish an additional 1 gal. (3.8 L) of each material and color applied.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- 1. Provide paint products by one of the following paint manufacturers:
  - a. Rodda Paint

- b. Miller Paint
- c. Sherwin Williams
- d. Kelly Moore

## 2.2 PAINT, GENERAL

### A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

### B. Colors: Match existing.

## 2.3 PRIMERS/SEALERS

### A. Interior Latex Primer/Sealer: MPI #50.

## 2.4 LATEX PAINTS

### A. Interior Latex (Satin): MPI #43 (Gloss Level 4).

## EXECUTION

## 2.5 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  1. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
  1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

## 2.6 PREPARATION AND APPLICATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- D. Painting Mechanical and Electrical Work: Paint items exposed to view as where indicated in drawings.
- E. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 099123

## SECTION 101100 - VISUAL DISPLAY SURFACES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Markerboards.
2. Tackboards.

#### 1.2 SUBMITTALS

A. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of panel joints.
2. Include sections of typical trim members.

B. Samples: For each exposed product and for each color and texture specified.

C. Qualification Data: For qualified Installer.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of fabrics.

E. Warranties: Sample of special warranties.

#### 1.3 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of motor-operated, sliding visual display units required for this Project.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Porcelain-Enamel Face Sheet: Manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; uncoated thickness indicated.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Claridge Products and Equipment, Inc.
    - b. PolyVision Corporation; a Steelcase company.
- B. Natural Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish[ with surface-burning characteristics indicated].
- C. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.

### 2.2 MARKERBOARD ASSEMBLIES

- A. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and 0.021-inch- (0.53-mm-) thick, porcelain-enamel face sheet with low-gloss finish.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. AARCO Products, Inc.
    - b. ADP Lemco, Inc.
    - c. Aywon.
    - d. Bangor Cork Company, Inc.
    - e. Best-Rite Manufacturing.
    - f. Claridge Products and Equipment, Inc.
    - g. Egan Visual Inc.
    - h. Ghent Manufacturing, Inc.
    - i. Marsh Industries, Inc.; Visual Products Group.
    - j. Platinum Visual Systems; a division of ABC School Equipment, Inc.
    - k. PolyVision Corporation; a Steelcase company.
    - l. Tri-Best Visual Display Products.
  - 2. Manufacturer's Standard Core: Minimum 1/4 inch (6 mm) thick, with manufacturer's standard moisture-barrier backing.
  - 3. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.

### 2.3 TACKBOARD ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. A-1 Visual Systems.
  - 2. AARCO Products, Inc.
  - 3. ADP Lemco, Inc.
  - 4. Aywon.
  - 5. Bangor Cork Company, Inc.
  - 6. Best-Rite Manufacturing.
  - 7. Claridge Products and Equipment, Inc.
  - 8. Egan Visual Inc.
  - 9. EverProducts by Glenroy Inc.
  - 10. Ghent Manufacturing, Inc.
  - 11. Marsh Industries, Inc.; Visual Products Group.
  - 12. Platinum Visual Systems; a division of ABC School Equipment, Inc.
  - 13. PolyVision Corporation; a Steelcase company.
  - 14. Tri-Best Visual Display Products.
- B. Natural-Cork Tackboard <Insert designation>: 1/4-inch- (6-mm-) thick, natural cork sheet factory laminated to 1/4-inch- (6-mm-) thick particleboard backing.

### 2.4 MARKERBOARD AND TACKBOARD ACCESSORIES

- A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; standard size and shape.
  - 1. Factory-Applied Trim: Manufacturer's standard.
- B. Chalktray: Manufacturer's standard, continuous.
  - 1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

### 2.5 FABRICATION

- A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
- B. Visual Display Boards: Factory assemble visual display boards unless otherwise indicated.
  - 1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.
- C. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
- D. Modular Visual Display Boards: Fabricated with integral panel clips attached to core material.

- E. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.
  - 1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

## 2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

## 2.7 VISUAL DISPLAY SURFACE SCHEDULE

- A. Visual Display Board: Factory assembled.
  - 1. Markerboard: Porcelain-enamel markerboard assembly.
    - a. Color: White.
  - 2. Corners: Square.
  - 3. Width: As indicated on Drawings.
  - 4. Height: As indicated on Drawings.
  - 5. Mounting: Wall.
  - 6. Mounting Height: As indicated on Drawings.
  - 7. Factory Applied Aluminum Trim: Manufacturer's standard with clear anodic finish.
  - 8. Accessories:
    - a. Chalktray: Solid type.
- B. Tackboard: Factory assembled.
  - 1. Tack Surface: Natural-cork tackboard assembly.
  - 2. Corners: Square.
  - 3. Width: As indicated on Drawings.
  - 4. Height: As indicated on Drawings.
  - 5. Mounting: Wall.
  - 6. Mounting Height: As indicated on Drawings.
  - 7. Edges: Concealed by trim.
    - a. Factory Applied Aluminum Trim: Manufacturer's standard style, with clear anodic finish.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.

- B. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- C. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches (400 mm) o.c. Secure both top and bottom of boards to walls.
- D. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room. Cover and protect visual display surfaces.

END OF SECTION 101100

## SECTION 101400 - SIGNAGE

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Panel signs.

## 1.2 DEFINITIONS

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

## 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for signs.
  - 1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
  - 2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.

## 1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

## 2.2 PANEL SIGNS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Match existing sign material, color and style for all new or replacement signs.
- D. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner, complying with the following requirements:
  - 1. Acrylic Sheet: Match existing signage
  - 2. Edge Condition: Match existing signage.
  - 3. Corner Condition: Match existing signage
  - 4. Mounting: Unframed.
    - a. Wall mounted with concealed anchors.
    - b. Manufacturer's standard anchors for substrates encountered.
  - 5. Color: To match existing signage.
  - 6. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch (0.8 mm) above surface with contrasting colors.
- E. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
  - 1. Panel Material: Opaque acrylic sheet. To match existing signage.
  - 2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).
- F. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are UV and water resistant for five years for application intended.
  - 1. Color: To match existing signage.

## 2.3 ACCESSORIES

- A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

## 2.4 FABRICATION

- A. General: Provide manufacturer's standard signs of configurations indicated.
  - 1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of

exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.

2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
3. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

## 2.5 ACRYLIC SHEET FINISHES

- A. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
  1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
  2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.
- B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
  1. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.

END OF SECTION 101400

## SECTION 102600 - WALL AND DOOR PROTECTION

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Corner guards.

## 1.2 SUBMITTALS

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

## B. Shop Drawings: For each impact-resistant wall protection unit. Include sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## C. Samples: For each exposed product and for each color and texture specified, 12 inches long.

## D. Material certificates.

## E. Material test reports.

## F. Maintenance data.

## G. Warranty: Sample of special warranty.

## 1.3 QUALITY ASSURANCE

## A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

## B. Surface-Burning Characteristics: As determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

## 1.4 WARRANTY

## A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures.
  - b. Deterioration of plastic and other materials beyond normal use.
2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 CORNER GUARDS

- A. Surface-Mounted, Stainless Steel Corner Guards: Assembly consisting of adhered to substrate corner, including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition. Exposed surfaces shall be free of discoloration or other imperfections.
  1. Basis-of-Design Product: Subject to compliance with requirements, provide Koroseal, Korogard GS20 or comparable product by one of the following:
    - a. American Floor Products Co., Inc.
    - b. Arden Architectural Specialties, Inc.
    - c. Balco, Inc.
    - d. Construction Specialties, Inc.
    - e. IPC Door and Wall Protection Systems; Division of InPro Corporation.
    - f. Korogard Wall Protection Systems; a division of RJF International Corporation.
    - g. Musson Rubber Company.
    - h. Pawling Corporation.
    - i. Tepromark International, Inc.
    - j. WallGuard.com.
  2. Dimensions:
    - a. Leg length: 2 inches
    - b. Height: 48 inches
    - c. Angle: 90 degrees
  3. Material: 16-guage Stainless Steel, type 304
  4. Finish: #4 Satin
  5. Mounting: Manufacturer's recommended adhesive

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
  1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.

- B. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.
- C. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

## SECTION 104413 - FIRE EXTINGUISHER CABINETS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes fire protection cabinets for fire extinguishers.

## 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each exposed product and for each color and texture specified.
- D. Maintenance data.

## 1.3 QUALITY ASSURANCE

- A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.
- B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- C. Coordinate sizes and locations of fire protection cabinets with wall depths.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Stainless-Steel Sheet: ASTM A 666, Type 304.
- C. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 2 (tinted, heat absorbing, and light reducing), bronze tint.

## 2.2 FIRE PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Fire End & Croker Corporation;
  - b. J. L. Industries, Inc., a division of Activar Construction Products Group;
  - c. Kidde Residential and Commercial Division, Subsidiary of Kidde plc;
  - d. Larsen's Manufacturing Company;
  - e. Modern Metal Products, Division of Technico Inc.;
  - f. Moon-American;
  - g. Potter Roemer LLC;
  - h. Watrous Division, American Specialties, Inc.;
- B. Cabinet Construction: Nonrated.
- C. Cabinet Material: Stainless-steel sheet.
- D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
  1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
- E. Cabinet Trim Material: Same material and finish as door.
- F. Door Material: Stainless-steel sheet.
- G. Door Style: Center glass panel with frame.
- H. Door Glazing: Tempered float glass (bronze tint).
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
- J. Accessories:
  1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
  2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
  3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
    - a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER"
      - 1) Location: Applied to cabinet door.
      - 2) Application Process: Pressure-sensitive vinyl letters.
      - 3) Lettering Color: Black.

4) Orientation: Vertical.

K. Finishes:

1. Stainless Steel: No. 4.

## 2.3 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Miter and weld joints and grind smooth.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed and prepare recesses as required by type and size of cabinet and trim style.
- B. Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- C. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
- D. Identification: Apply vinyl lettering at locations indicated.
- E. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- F. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

## SECTION 104416 - FIRE EXTINGUISHERS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

## 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.
- C. Warranty: Sample of special warranty.

## 1.3 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
- C. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

## 1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure of hydrostatic test according to NFPA 10.
    - b. Faulty operation of valves or release levers.
  - 2. Warranty Period: Six years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Amerex Corporation.
    - b. Ansul Incorporated; Tyco International Ltd.
    - c. Badger Fire Protection; a Kidde company.
    - d. Buckeye Fire Equipment Company.
    - e. Fire End & Croker Corporation.
    - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
    - g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
    - h. Larsen's Manufacturing Company.
    - i. Moon-American.
    - j. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
    - k. Potter Roemer LLC.
    - l. Pyro-Chem; Tyco Safety Products.
  2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type: UL-rated 10 lb. nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

### 2.2 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or [red] [black] baked-enamel finish.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Amerex Corporation.
    - b. Ansul Incorporated; Tyco International Ltd.
    - c. Badger Fire Protection; a Kidde company.
    - d. Buckeye Fire Equipment Company.
    - e. Fire End & Croker Corporation.
    - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
    - g. Larsen's Manufacturing Company.
    - h. Potter Roemer LLC.

- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
  - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
    - a. Orientation: Vertical.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
  - 1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

## SECTION 105113 - METAL LOCKERS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Standard metal lockers.

## 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For metal lockers. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For units with factory-applied color finishes.
- D. Maintenance data.
- E. Warranty: Sample of special warranty.

## 1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Where metal lockers and benches are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1.

## 1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
  - 1. Warranty Period for Knocked-Down Metal Lockers: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with A60 (ZF180) zinc-iron, alloy (galvannealed) coating designation.
- C. Expanded Metal: ASTM F 1267, Type II (flattened), Class I, 3/4-inch (19-mm) steel mesh, with at least 70 percent open area.
- D. Stainless-Steel Sheet: ASTM A 666, Type 304.
- E. Extruded Aluminum: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated.
- F. Steel Tube: ASTM A 500, cold rolled.
- G. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- H. Anchors: Material, type, and size required for secure anchorage to each substrate.
  - 1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts for corrosion resistance.
  - 2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

### 2.2 STANDARD METAL LOCKERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
  - 1. Art Metal Products;
  - 2. ASI Storage Solutions Inc.;
  - 3. DeBourgh Mfg. Co.;
  - 4. General Storage Systems Ltd.;
  - 5. Hadrian Manufacturing Inc.;
  - 6. List Industries Inc.;
  - 7. Lyon Workspace Products, LLC;
  - 8. Penco Products, Inc.;
  - 9. Republic Storage Systems Company;
  - 10. Shanahan's Manufacturing Limited; Deluxe Series Lockers.
  - 11. Tennsco Corp.; Tennsco Lockers.
- B. Locker Arrangement: Double tier.
- C. Material: Cold-rolled steel sheet.

- D. Body and Shelves: Assembled by riveting or bolting body components together. Fabricate from unperforated 0.024-inch (0.61-mm) nominal-thickness steel sheet.
- E. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.
- F. Doors: One piece; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
1. Doors less than 12 inches (305 mm) wide may be fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
  2. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.
  3. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet; welded to inner face of doors.
  4. Sound-Dampening Panels: Manufacturer's standard, designed to stiffen doors and reduce sound levels when doors are closed, of die-formed metal with full perimeter flange and sound-dampening material; welded to inner face of doors.
  5. Door Style: Louvered vents at top and bottom.
- G. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
1. Continuous Hinges: Manufacturer's standard, steel, full height.
- A. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry and vandal resistant.
1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in key locks, or padlocks; positive automatic latching and prelocking.
    - a. Latch Hooks: Equip **doors 48 inches (1219 mm) and higher with three latch hooks and doors less than 48 inches (1219 mm) high with two latch hooks**; fabricated from **0.105-inch (2.66-mm)** nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
    - b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated **with vinyl or nylon** to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.
- B. Combination Padlocks: Provided by User.
- C. Equipment: Equip each metal locker with identification plate and the following unless otherwise indicated:
1. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.

## D. Accessories:

1. Legs: 6 inches (152 mm) high; fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet; welded to bottom of locker.
  - a. Closed Front and End Bases: Fabricated from 0.036-inch (0.91-mm) nominal-thickness steel sheet.
2. Continuous Sloping Tops: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch (0.91-mm) nominal-thickness steel sheet.
  - a. Closures: Vertical type.
3. Recess Trim: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
4. Filler Panels: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch (0.91-mm) nominal-thickness steel sheet.
5. Finished End Panels: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet.

## E. Finish: Baked enamel or powder coat.

1. Color(s): Two colors, with door one color and frame and body another color; as selected by Architect from manufacturer's full range.

## 2.3 FABRICATION

- A. Fabricate metal lockers square, rigid, and without warp and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
  1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
  2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.
- C. Knocked-Down Construction: Fabricate metal lockers using nuts, bolts, screws, or rivets for nominal assembly at Project site.
- D. Accessible Lockers: Fabricate as follows:
  1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
  2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.
- E. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.
- F. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch (9 mm) high.

- G. Continuous Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.
- H. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.
  - 1. Sloping-top corner fillers, mitered.
- I. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.
- J. Boxed End Panels: Fabricated with 1-inch- (25-mm-) wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.
  - 1. Provide one-piece panels for double-row (back-to-back) locker ends.
- K. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
  - 1. Provide one-piece panels for double-row (back-to-back) locker ends.

## 2.4 STEEL SHEET FINISHES

- A. Baked-Enamel Finish: Immediately after cleaning, pretreating, and phosphatizing, apply manufacturer's standard thermosetting baked-enamel finish. Comply with paint manufacturer's written instructions for application, baking, and minimum dry film thickness.
- B. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard, baked-polymer, thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install level, plumb, and true; shim as required, using concealed shims.
  - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
  - 2. Anchor single rows of metal lockers to walls near top of lockers and to floor.
  - 3. Anchor back-to-back metal lockers to floor.
- B. Knocked-Down Metal Lockers: Assemble with standard fasteners, with no exposed fasteners on door faces or face frames.
- C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
  - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
4. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
5. Attach sloping-top units to metal lockers, with closures at exposed ends.
6. Attach boxed end panels with concealed fasteners to conceal exposed ends of nonrecessed metal lockers.
7. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

END OF SECTION 105113

## SECTION 133419 - METAL BUILDING SYSTEMS (Covered Program Structure)

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Structural-steel framing.
2. Metal roof panels.
3. Metal soffit panels.
4. Accessories.

## 1.2 SUBMITTALS

- A. Product Data: For each type of metal building system component.
- B. Shop Drawings: For metal building system components. Include plans, elevations, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For metal building systems indicated to comply with performance requirements and design criteria, including analysis data and calculations signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Welding certificates.
- E. Metal Building System Certificates: For each type of metal building system, from manufacturer.
  1. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
    - a. Name and location of Project.
    - b. Order number.
    - c. Name of manufacturer.
    - d. Name of Contractor.
    - e. Building dimensions including width, length, height, and roof slope.
    - f. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
    - g. Governing building code and year of edition.
    - h. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
    - i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
    - j. Building-Use Category: Indicate category of building use and its effect on load importance factors.

- k. AISC Certification for Category MB: Include statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.

- F. Material test reports.
- G. Source quality-control reports.
- H. Field quality-control reports.
- I. Maintenance data.
- J. Warranties: Sample of special warranties.

### 1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer and member of MBMA.
  - 1. AISC Certification for Category MB: An AISC-Certified Manufacturer that designs and produces metal building systems and components in an AISC-Certified Facility.
  - 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."
- D. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.
- E. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- F. Preinstallation Conference: Conduct conference at Project site for each building.

### 1.4 WARRANTY

- A. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Finish Warranty Period: 30 years from date of Substantial Completion.

- B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.
  - 1. Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 METAL BUILDING SYSTEM PERFORMANCE

- A. Delegated Design: Design metal building system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Metal building systems shall be designed according to procedures in MBMA's "Metal Building Systems Manual."
  - 1. Design Loads: As indicated on Drawings.
  - 2. Deflection Limits: Design metal building system assemblies to withstand design loads with deflections no greater than the following:
    - a. Purlins and Rafters: Vertical deflection of 1/180 of the span.
    - b. Metal Roof Panels: Vertical deflection of 1/180 of the span.
    - c. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
  - 3. Drift Limits: Engineer building structure to withstand design loads with drift limits no greater than the following:
    - a. Lateral Drift: Maximum of 1/75 of the building height.
  - 4. Metal panel assemblies shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to ASTM E 1592.
- C. Seismic Performance: Metal building systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- D. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Air Infiltration for Metal Roof Panels: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of roof area when tested according to ASTM E 1680 at negative test-pressure difference of 1.57 lbf/sq. ft. (75 Pa)].

- F. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E 1646 at test-pressure difference of 2.86 lbf/sq. ft. (137 Pa).

## 2.2 STRUCTURAL-STEEL FRAMING

- A. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
  - 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly.
  - 2. Frame Configuration: As indicated on drawings.
  - 3. Exterior Column Type: Uniform depth or Tapered.
  - 4. Rafter Type: Either Uniform depth or Tapered.
- B. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating.
- C. Bolts: Provide plain-finish bolts for structural-framing components that are primed or finish painted. Provide zinc-plated or hot-dip galvanized bolts for structural-framing components that are galvanized.
- D. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.
  - 1. Field Paint:
    - a. Interior: Field paint all primary structure members exposed in finished showroom and office spaces.
    - b. Exterior: Field paint all primary structure members at exterior conditions as indicated on elevation drawings.

## 2.3 METAL ROOF PANELS

- A. Vertical-Rib, Standing-Seam Metal Roof Panels: Formed with ribs at panel edges; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
  - 1. Material: Aluminum-zinc alloy-coated steel sheet, 24 gauge nominal thickness.
    - a. Exterior Finish: Two-coat fluoropolymer.
    - b. Color: Color as selected from manufacturer standard color palette.
  - 2. Clips: Manufacturer's standard, floating type to accommodate thermal movement; fabricated from zinc-coated (galvanized) steel, aluminum-zinc alloy-coated steel, or stainless-steel sheet.
  - 3. Joint Type: Mechanically seamed, single folded.
  - 4. Panel Coverage: 24 inches (609 mm).

5. Panel Height: 2 inches (51 mm).
6. Uplift Rating: UL 90.

## 2.4 METAL SOFFIT PANELS

- A. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
- B. Metal Soffit Panels: Manufacturer standard soffit profile panel.
  1. Finish: Color as selected from manufacturer standard color palette.

## 2.5 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
  1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
- C. Flashing and Trim: Formed from 0.022-inch (0.56-mm) nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match adjacent metal panels.
- D. Gutters: Formed from 0.022-inch (0.56-mm) nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2438-mm-) long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
  1. Gutter Supports: Fabricated from same material and finish as gutters.
  2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.
- E. Downspouts: Formed from 0.022-inch (0.56-mm) nominal-thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot- (3-m-) long sections, complete with formed elbows and offsets.
  1. Mounting Straps: Fabricated from same material and finish as gutters.

- F. Roof Ventilators: Gravity type, complete with hardware, flashing, closures, and fittings.
  - 1. Continuous or Sectional-Ridge Type: Factory-engineered and -fabricated, continuous unit; fabricated from 0.022-inch (0.56-mm) nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal roof panels. Fabricated in minimum 10-foot- (3-m-) long sections. Provide throat size and total length indicated, complete with side baffles, ventilator assembly, end caps, splice plates, and reinforcing diaphragms.
    - a. Bird Screening: Galvanized steel or aluminum.
    - b. Throat Size: 9 or 12 inches (229 or 305 mm), as standard with manufacturer, and as required to comply with ventilation requirements.
- G. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

## 2.6 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate product.
- B. Special Inspector: Owner will engage a qualified special inspector to perform the following tests and inspections and to submit reports. Special inspector will verify that manufacturer maintains detailed fabrication and quality-control procedures and will review the completeness and adequacy of those procedures to perform the Work.
  - 1. Special inspections will not be required if fabrication is performed by manufacturer registered and approved by authorities having jurisdiction to perform such Work without special inspection.
    - a. After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed according to Contract requirements.
- C. Testing: Test and inspect shop connections for metal buildings according to the following:
  - 1. Bolted Connections: Shop-bolted connections shall be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
  - 2. Welded Connections: In addition to visual inspection, shop-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94.
- D. Product will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

## 2.7 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
  - 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
  - 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
- D. Secondary Framing: Shop fabricate framing components to size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

## PART 3 - EXECUTION

### 3.1 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
  2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.
    - a. Joint Type: Snug tightened or pretensioned.
- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
  2. Locate and space wall girts to suit openings such as doors and windows.
  3. Locate canopy framing as indicated.
  4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- H. Steel Joists: Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders," joist manufacturer's written instructions, and requirements in this Section.
1. Before installation, splice joists delivered to Project site in more than one piece.
  2. Space, adjust, and align joists accurately in location before permanently fastening.
  3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
  4. Bolt joists to supporting steel framework using carbon-steel bolts unless high-strength structural bolts are required by the manufacturer.
  5. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
  6. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.
- I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.

1. Tighten rod and cable bracing to avoid sag.
  2. Locate interior end-bay bracing only where indicated.
- J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

### 3.2 METAL PANEL INSTALLATION, GENERAL

- A. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
    - a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
  2. Install metal panels perpendicular to structural supports unless otherwise indicated.
  3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
  4. Locate and space fastenings in uniform vertical and horizontal alignment.
  5. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment.
  6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- B. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- C. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants recommended by metal panel manufacturer.
1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
  2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

### 3.3 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
1. Install ridge caps as metal roof panel work proceeds.

2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
1. Install clips to supports with self-drilling or self-tapping fasteners.
  2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
  3. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
  4. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels for fasteners.
  5. Provide metal closures at peaks, rake edges, rake walls and each side of ridge caps.
- C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

### 3.4 METAL SOFFIT PANEL INSTALLATION

- A. Provide metal soffit panels the full width of soffits. Install panels perpendicular to support framing.
- B. Flash and seal metal soffit panels with weather closures where panels meet walls and at perimeter of all openings.

### 3.5 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
  2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
  3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
  2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.
1. Tie downspouts to underground drainage system indicated.
- E. Continuous Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Join sections with splice plates and end-cap skirt assemblies where required to achieve indicated length. Install preformed filler strips at base to seal ventilator to metal roof panels.
- F. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

### 3.6 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.
- B. Tests and Inspections:
1. High-Strength, Field-Bolted Connections: Connections shall be tested and inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
  2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94.

- C. Product will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 133419

DIVISION 21 MASTER FIRE SUPPRESSION SPECIFICATION

SECTION 21 0000	GENERAL MECHANICAL PROVISIONS
SECTION 21 0500	BASIC MATERIALS AND METHODS
SECTION 21 0510	PIPE AND PIPE FITTINGS
SECTION 21 0523	VALVES
SECTION 21 0529	SUPPORTS AND ANCHORS
SECTION 21 1300	FIRE SPRINKLER SYSTEM

## SECTION 21 0000 - GENERAL PROVISIONS

## PART 1 - GENERAL

- 1.1 GENERAL REQUIREMENTS: Drawings and general provisions of the Contract, including General and other conditions and Division 01 General requirements Sections apply for the work specified in this Section.
- 1.2 SCOPE OF WORK: The work covered by this Specification shall include furnishing all labor, materials, equipment and services to design, construct and install the complete fire suppression system specified herein. Verify all conditions on the job site and lay out work accordingly.
- 1.3 RELATED WORK:
- A. The General Provisions apply to this Division, including but not limited to:
1. Drawings and Specifications.
  2. Contract Modifications, addendums and change orders.
- B. Division 1, General Requirements, applies to this Division, including but not limited to:
1. Summary of Work.
  2. Coordination, Division 01. In addition, it shall be the responsibility of each trade performing work specified under Division 21 to coordinate with all others for proper and adequate installation clearance.
  3. Cutting and Patching. The cost of cutting and patching required work of Division 21 and not shown in other Divisions of Work shall be included in the cost of Division 21.
  4. Shop Drawings, Product Data and Samples.
  5. Temporary Facilities and Controls.
  6. Material and Equipment.
  7. Substitutions and Product Options.
  8. Contract Closeout:
    - a. Project Record Documents. Keep up to date marked up Drawings on site.
    - b. Operations and Maintenance Data.
    - c. Start-up.
- C. Related work provided in Divisions 02 through 14:
1. Pipe chases and formed concrete work except as specified hereunder.
  2. Framed openings in masonry, concrete, wood and other architectural and structural elements.
  3. Wood grounds and nailing strips in masonry and concrete.
  4. Installation only of access panels in ceilings, walls, etc. Provide access panels as part of mechanical work.
  5. Painting except as specified hereunder.

6. Curbs and roof flashings for openings through roofs, except for roof drain and vent pipe flashing.

D. Related Work provided in Division 26 & 28:

1. Motor disconnect switches and installation except as specified herein.
2. Motor starters and installation except as herein specified.
3. Power wiring except as specified herein.

1.4 QUALITY ASSURANCE:

A. Regulatory Requirements:

1. All work, installations, materials and equipment shall comply with the provision of the following codes, standards and regulations, except where more stringent requirements are shown or specified:
  - a. State of Oregon Fire Code. (IFC)
  - b. National Fire Protection Agency. (NFPA)
  - c. State of Oregon International Mechanical Code. (IMC)
  - d. State of Oregon Plumbing Specialty Code. (UPC)
  - e. State of Oregon Structural Specialty Code. (IBC)
  - f. National Electrical Code. (NEC)
  - g. All City, County, State and Federal applicable laws and regulations.
  - h. Regulations and standards set forth by ASME, ASHRAE, SMACNA, AGA and ARI.
2. Should there be any direct conflict between Codes and the Drawings and Specifications, the Codes, rules and regulations shall govern.
3. Where two or more codes or regulations apply, the more stringent of the two shall be exercised.
4. Should the Documents indicate a condition, which will conflict with the Codes, the Contractor shall inform the Owner's Representative and refrain from installing that portion until resolved. Any work installed in violation of the Codes will be removed and correctly installed as part of the Contract work.
5. If the Drawings and Specifications indicate a higher quality than code, the Drawings and Specifications shall govern.
6. Electrical products shall bear the U.L. label.

B. The entire mechanical system shall operate correctly at full capacity without objectionable noise, vibration or decrease of efficiency.

C. Materials and Equipments:

1. Equipment furnished shall meet all requirements of the Drawings and Specifications and be suitable for the installation. Equipment not meeting all requirements will not be acceptable.
2. Where two or more units of the same class of equipment are furnished, use products of the same manufacturer.
3. Furnish all materials and equipment, new and of size, type and quality herein specified.

- D. Workmanship:
  - 1. Follow manufacturers' instructions. If they are in conflict with the Drawings and Specifications, obtain clarification from the Architect prior to beginning the work.
- E. Cutting and Patching:
  - 1. Provide for cutting, patching and repairing for the installation of the work specified, including masonry work, concrete work, carpentry work and painting. Work shall be performed by skilled craftsmen of the respective trade.

#### 1.5 DRAWINGS:

- A. The Drawings and Specifications are complementary and what is called for by one shall be as if called for by both. All items shown on the Drawings are not necessarily included in the Specifications. All directives and instructions to furnish, provide, install, complete and test described in the design documents shall be interpreted as directives unless clearly specified otherwise.
- B. Bring obscure or questionable items to the attention of the Owner's Representative prior to bid date. Necessary directions and explanations will be given by the Owner's Representative in Addendum Form.
- C. Should the Documents indicate a condition which will conflict with the Governing Codes and Regulations, the Contractor shall refrain from installing that portion of the work until receiving verification from the Owner's Representative. Should rearrangement or rerouting of duct or piping be necessary, provide for approval the simplest layout possible for that particular portion of the work. Any work installed in violation of the Governing Codes will be removed and correctly installed by the Contractor as part of the Contract work.
- D. Drawings (if provided) are intended to show design intent only. They do not show design details. Do not scale drawings for roughing-in measurements, nor use as shop or design drawings. Make field measurements and prepare shop drawings as required. Coordinate work with shop drawings of other trades. It is the responsibility of the contractor to provide final design and calculations.
- E. It is the intent of these specifications that the field wiring of all systems provided and modified under this contract shall be complete and operable. Refer to all drawings and specifications, especially the electrical drawings, to determine voltage, phase, circuit ampacity and number of connections indicated. Bring to the attention of the Engineer all conflicts, incompatibilities and discrepancies prior to bid.
- F. Where equipment, risers or valves are shown, dimensions have been taken from typical equipment of the class indicated. Carefully check the Drawings to see that the equipment under consideration for installation will fit the space provided and that all connections may be made thereto without impairment of space and height requirements and of Code required clearances. Contractor is responsible for all changes required by equipment dimensions different than those shown.

- G. Where manufacturer and model numbers are listed it is the most recent and/or desired to describe function and quality of equipment to be supplied and installed. Since manufacturers may change model numbers without notification, should the model specified be unavailable, furnish and install the model number that is equal to or better than the one listed.
- H. The location of all utilities, wires, conduits, pipes, duct, or other service facilities are shown in a general way only on the Drawings and are taken from existing public records. Ascertain whether any additional facilities other than those shown on the plans may be present and determine the exact location and elevations of all utilities prior to commencing installation.
- I. Prior to bid, contact the local utility companies to verify requirements & available water flow and pressures. Provide all material and labor by utilities.
- J. The Contractor, before submitting a Bid on the work, must visit the site to become familiar with all visible existing conditions. As a result of having visited the premises, the Contractor shall be responsible for the installation of the work as it relates to such visible existing conditions. The submission of the bid will be considered an acknowledgement of the part of the Bidder of visitation to the site.
- K. The Contractor is responsible to apply for and obtain all necessary permits, fees and inspections required by any public authority having jurisdiction. Refer to General Conditions for additional information.

#### 1.6 SUBSTITUTION AND PRODUCT OPTIONS:

- A. The use of manufacturer's names, models and numbers in the Drawings and Specifications is intended to establish style, quality, appearance and usefulness. The model numbers listed are the last available to the designer, if no longer current, substitute equipment equal to or better than that represented by the model number listed. Items noted "or equivalent" will require prior acceptance.
- B. Submit for the Owner's Representative's review, manufacturer's detailed specifications and data sheets for all proposed substitutions. Submittals shall consist of a single sheet, or specific data need for consideration of approval. All pertinent data listed in the Specifications and on the Drawings shall be furnished, including all special features. See that all submittals are in proper order, and that all equipment will fit the space provided.
- C. All requests for approval of substitutions for materials other than those specified must be submitted in accordance with Instruction to Bidder.
- D. Substitution products from approved manufacturers do not need prior approval. Ensure substitutions meet all requirements of the Specifications.
- E. All changes required due to product substitutions are the responsibility of the Contractor.

#### 1.7 PROJECT RECORD DRAWINGS:

- A. Obtain drawings from Architect.

- B. Keep Drawings clean, undamaged and up to date.
  - C. Record and accurately indicate the following:
    - 1. Depths, sizes and locations of all buried and concealed piping.
    - 2. Locations of all clean-outs.
    - 3. Changes, additions and revisions due to contract modifications.
    - 4. Locations of tracer wire terminal points.
  - D. Drawings to be available for Architect review.
  - E. Submit as a part of Project Closeout Documents
- 1.8 PROJECT CONDITIONS:
- A. Existing Conditions: Prior to bidding, verify and become familiar with all existing conditions by visiting the site and include all factors which may affect the execution of this work. Include all related costs in the initial bid proposal.
  - B. Coordinate exact requirements governed by actual job conditions. Check all information and report all discrepancies before fabrication work. Report changes in the time to avoid unnecessary work. Make changes as directed by Owner's Representative.
- 1.9 CONTRACT MODIFICATIONS:
- A. In addition to the requirements of the General provisions, all supplemental cost proposals for this Division of work shall be accompanied by a complete itemized breakdown of labor and materials for each item. No exceptions will be made. Contract's estimating sheets for supplemental cost proposals shall be made available upon request. Labor must be separated and allocated to each item of work. Changes or additions subject to additional compensation made without written authorization based on agreed price shall be at Contractor's own risk and expense.
- 1.10 STORAGE AND HANDLING:
- A. Delivery: Deliver to project site with manufacturer's labels intact and legible.
  - B. Handling: Avoid damage.
  - C. Storage: Store material inside, protected from weather, dirt and construction dust. Where necessary to store outside, elevate well above grade and enclose with durable, waterproof wrapping.
- 1.11 WARRANTY:
- A. Provide a written guaranty covering the work of this Division for a period of one calendar year from the date of acceptance of the entire project as required by the General Provisions.

- B. Provide manufacturer's written warranties for material and equipment furnished under this Division insuring parts and labor for a period of one year from the date of acceptance of the entire project.
- C. Correct warranty items promptly upon notification.

#### 1.12 OPERATIONS AND MAINTENANCE DATA:

- A. Prior to final inspection, provide three (3) copies of manufacturer's maintenance manuals for each piece of equipment or items requiring service. Manual shall include manufacturer's operation and maintenance instruction manuals and parts list for each piece of equipment or item requiring servicing. Include in the manual manufacturer's service data, wiring diagrams and parts lists for all major items of equipment, valve charts, and any additional equipment added by contract modification. Comply with provisions of Division 1 where applicable.
- B. Submit bound in 8-1/2 x 11 inch text pages, three ring binders with durable plastic covers.
- C. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
- D. Internally subdivide the binder contents with permanent page dividers, logically organized with tab titling clearly printed under reinforced lamed plastic table.

#### 1.13 SUBMITTALS:

- A. Shop Drawings: The Contract Drawings indicate the general layout of the piping, ductwork and various items of equipment. Prepare and submit for review Shop Drawings of all installation not detailed on the Contract Drawings and all changes to the Contract Drawings.
- B. Product Data:
  - 1. Submit for review manufacturer's detailed shop drawings, specifications and stat sheets for all equipment to be furnished, as well as any wiring diagram showing field installed wiring and devices. Arrangement of fire suppression equipment has been based on items of specific manufacturer intended as somewhat typical of several makes, which may be approved.
  - 2. Indicate construction, capacities, accessories, etc. Manufacturer's abbreviations or codes are not acceptable.
  - 3. List the name of the motor manufacturer for each piece of equipment.
- C. Submission Requirements:
  - 1. Shop Drawings and Product Data:
    - a. Submit all equipment and product data for Work of Division 21 together in a group in a 3-ring loose-leaf binder, with each item field under a tab, and labeled with its respective specification section number, article and paragraph, and mark if applicable.

- b. Include a complete index in the original submittal. Indicate both original items submitted and note stragglers that will be submitted at a later date to avoid delay in submitting.
  - c. Additional product data submitted after return of the original binder shall include a tab similar to the originally submitted. Upon receipt of the return submittal, insert them in the previously submitted binder.
  - d. Refer to Division 1 for number of shop drawing copies to be submitted.
  - e. Indication of unit, model, features, etc being submitted must be marked by bold arrow, bold circle or other clear means that will reproduce in black and white. Use of highlights, colored text or other colored indicators cannot be used.
2. Sample: Submit samples required by each Section of Division 21 at the same time that shop drawings and product data are submitted.
- D. It shall be the Contractor's responsibility to:
1. See that all submittals are in proper order.
  2. Ensure that all equipment will fit in the space provided.
  3. Assure that all deviation from Drawings and Specification are specifically noted and called to the attention of the Engineer/Architect/Contracting Officer in the submittals. Failure to comply will void approval automatically.
  4. Deviation, discrepancies, and conflicts between the submittals and the contract documents discovered prior to or after the review process shall not relieve the Contractor of this responsibility to comply with the contract documents.
- E. Electronic Submission Requirements:
1. Shop Drawings and Product Data:
    - a. Submit all equipment and product data for Work of Division 15 together in a group in a single PDF format file, with each item filed behind a cover sheet, and labeled with its respective specification section number, article and paragraph, and mark if applicable.
    - b. Include a complete index in the original submittal. Indicate both original items submitted and note stragglers that will be submitted at a later date to avoid delay in submitting.
    - c. Additional product data submitted after return of the original file shall include a cover sheet similar to that originally submitted. Upon receipt of the return submittal, insert them in the previously submitted electronic file.
    - d. Submission of overall line or general catalog data will not be accepted, submittals must be tailored to specific model being submitted on.
    - e. Indication of unit, model, features, etc being submitted must be marked by bold arrow, bold circle or other clear means that will reproduce in black and white. Use of highlights, colored text or other colored indicators cannot be used.
    - f. Electronic submissions review and comment will be in electronic PDF format only. Submission in an electronic format will be considered acceptance of this review process and format.
    - g. Refer to Division 01 for number of shop drawing copies to be submitted.

- 1.14 START-UP:
- A. Coordinate schedule for start-up of various equipment and systems.
  - B. Notify Owner's Representative seven days prior to start-up of each item.
  - C. Verify that each piece of equipment of system has been checked prior to start-up for proper lubrication, drive rotation, belt tension, control sequence, or other conditions, which may cause damage.
  - D. Verify that tests, meter readings and specified electrical characteristics agree with those required by the equipment or system manufacturer.
  - E. Verify that wiring and support components for equipment are completed and tested.
  - F. Execute start-up under supervision of responsible manufacturer's representative or Contractor's personnel in accordance with manufacturer's instructions.
- 1.15 FEES, PERMITS AND INSPECTIONS: The Contractor is responsible to apply for and obtain all necessary permits, fees and inspections required by any public authority having jurisdiction. Refer to General Conditions for additional information.
- 1.16 DEFINITIONS:
- A. "Furnish: Means to supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations.
  - B. "Install": Describes operations at project site including actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations.
  - C. "Provide": Means to furnish and Install, complete and ready for intended use.

## PART 2 - PRODUCTS

- 2.1 MATERIAL:
- A. All materials and products used for construction shall be new, of the best grade, and latest products as listed in printed catalog data. All articles of a kind shall be the standard product of a single manufacturer. Trade names and manufacturers names denote a character and quality of equipment desired and shall no be construed as limiting competition.
  - B. Asbestos: Do not use products made of or containing asbestos.

**2.2 QUALITY ASSURANCE:**

- A. Refer to Division 1 Material and Equipment for information regarding available alternatives to materials and equipment specified herein. Product listings are for informational purposes only and establish a general standard of quality.
- B. Provide products which are compatible with other portions of the work and provide products with the proper and correct power and fuel burner characteristics and similar adaptations for the project.

**2.3 INSPECTION:**

- A. All work and materials are subject to field observation at any and all times by the Owner's Representative.
- B. The Contractor shall notify the Owner's Representative a minimum of two days prior to testing any piping system which must be witnessed and accepted before it is covered up or enclosed.
- C. If an observer finds any material or work not conforming to these Specifications, within three days after being notified, remove the materials from the premises and replace with approved materials. If the material has been installed, the entire expense of removing and replacing shall be borne of the Contractor.

**PART 3 - EXECUTION****3.1 EQUIPMENT PROTECTION:**

- A. Keep pipe openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect piping, fixtures, valves, equipment and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore damaged or contaminated fixtures, equipment or apparatus to original conditions or replace at no cost to the Owner.
- B. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.
- C. Cover or otherwise suitably protect equipment and materials stored on the job site.

**3.2 CLEANING:**

- A. General: Clean fire suppression equipment, fixtures, piping and valves of stampings and markings (except those required by codes), iron cuttings, and other refuse.
- B. Painted Surfaces: Clean scratched or marred painted surfaces of rust or other foreign mater and paint with matching color industrial enamel, except as otherwise noted.

- C. Before operating any equipment or systems, make thorough check to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated and serviced. Check factory instructions to see that installations have been made accordingly and that recommended lubricants have been used.
- D. Use particular care in lubricating bearings to avoid damage by over-lubrication and blowing out seals. Check equipment for damage that may have occurred during shipment, after delivery or during installation. Repair damaged equipment as approved or replace with new equipment.

### 3.3 LAYOUT AND COORDINATION:

- A. Site Examination: Before starting work, carefully examine site and all contract Drawings so as to become thoroughly familiar with conditions governing work on this project. Verify all indicated elevations, building measurements, roughing-in dimensions and equipment locations before proceeding with any of the work.
- B. The existence of any wires, conduits, pipes, ducts or other service facilities are shown in a general way only. It will be the duty of the Contractor to visit the site and make exact determination of the existence of any such facilities prior to submitting a bid. It is understood that the Contractor will be responsible for making the exact determination of the location and condition of these facilities.
- C. The location of all utilities indicated on the plans is taken from available public records. The exact location and elevation of all public utilities must be determined by the Contractor. It shall be the duty of the Contractor to ascertain whether any additional facilities other than those shown may be present.
- D. Sleeves, Insets, Cast-in-Place Work: provide sleeves, inserts, anchoring devices, cast-in-place work, etc. which must be set in concrete sequenced at the proper time for the project schedule.
- E. Coordination:
  - 1. Where the work must be sequenced and positioned with precision in order to fit into the available space, prepare accurate scale shop drawings showing the actual physical dimensions required for the installation and submit prior to purchase-fabrication-installation of any of the elements involved in the coordination.
  - 2. Cooperate with other trades in furnishing material and information for sleeves, bucks, chases, mountings, backing, foundations and wiring required for installation of mechanical items.
  - 3. Coordinate all work with other trades and determine in advance where interfacing of the fire suppression work and other work are required to be connected together. Provide all materials and equipment to make those connections. Submit shop drawings showing required connections where special conditions exist.
- F. Discrepancies: Report immediately any error, conflict or discrepancy in Plans, Specifications and/or existing conditions. Do not proceed with any questionable items of work until clarification of same has been made. Should rearrangement or re-routing of piping be necessary, provide for approval the simplest layout possible for that particular portion of the work.

3.4 TEMPORARY FACILITIES AND CONTROLS:

- A. Comply with Division 01 requirements.
- B. Owner's warranties shall not be abridged by Contractor's use of the permanent systems' equipment prior to final acceptance. Warranty period shall begin at final completion.

3.5 MECHANICAL WORK CLOSEOUT:

- A. General: Refer to the Division 01 sections for general closeout requirements. Calibrate all equipment requiring same.
- B. Record Drawings: Submit record set of drawings required in Division 01, Submittals and as previously specified in this Section.
- C. Closeout Equipment/Systems Operations: Sequence operations properly so that work of project will not be damaged or endangered. Coordinate with seasonal requirements. Operate each item of equipment and each system in a test run of appropriate duration with the Architect present, and with the Owner's operating personnel present, to demonstrate sustained, satisfactory performance. Adjust and correct operations as required for proper performance. Clean and lubricate each system, and replace dirty strainers, excessively worn parts and similar expendable items of the work.
- D. Operation and Instruction: Provide six (6) hours of on-site training to Owner's personnel on all mechanical systems and equipment. Training shall include maintenance, lubrication, troubleshooting and repair. Contractor shall provide necessary written manuals and training aides explaining operational diagrams, emergency and alarm provisions, sequencing requirements, seasonal provisions, security, safety and similar features of the installed system. Three (3) copies of written manuals shall be left with Owner at end of training.

END OF SECTION

## SECTION 21 0500 - BASIC MATERIALS AND METHODS

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES:

- A. Items common to more than one section of Division 21 and general construction procedures and products. Work described in this Section applies to all Sections of Division 21.

## 1.2 STORAGE AND HANDLING:

- A. Deliver materials to the project site with manufacturer's labels intact and legible. Handle materials with care to avoid damage. Store materials inside protected from weather, dirt and construction dust. Where necessary to store outside, elevate well above grade and enclose with durable, waterproof wrapping. Label equipment as soon as it arrives at job site.

## 1.3 SUBMITTALS:

- A. Submit product data under provisions of Section 21 0000 and Division 1.
- B. Provide submittals for:
  - 1. Alarm Panels.
  - 2. Pipe sleeves
  - 3. Escutcheons.
  - 4. Piping and Equipment Identification.
  - 5. Valve Schedule.

## PART 2 - PRODUCTS

## 2.1 QUALITY ASSURANCE:

- A. Refer to Division 1 Material and Equipment for information regarding available alternatives to materials and equipment specified herein. Product listings are for informational purposes only and establish a general standard of quality.
- B. Provide products which are compatible with other portions of the work and provide products with the proper and correct power and fuel burner characteristics and similar adaptations for the project.

**2.2 MATERIALS:**

- A. All materials and products used for construction shall be new, of the best grade, and the latest products as listed in printed catalog data.
- B. All articles of a kind shall be the standard product of a single manufacturer.
- C. Provide products which are compatible with other portions of the work and products which have the proper electrical power and fuel-burning characteristics for this project.
- D. Trade names and manufacturers names denote the character and quality of equipment desired and shall not be construed as limiting competition.

**2.3 ACCESS PANELS:**

- A. Access panels shall have same fire rating as surface where mounted.
- B. Provide flush key cylinder locks on all access panels less than 8 feet above the floor in public spaces. Turn keys over to Owner at project completion. Screwdriver latches on all others.
- C. Steel, 24" x 24" or as required. Complete with steel frame, hinged locating door, and prime coat finish. Type to match building construction.
- D. Manufacturers: INRYCO/MILCOR Style DW, K or M panels as required by construction. Bilco, Potter-Roemer or accepted substitute.

**2.4 PIPE SLEEVES:**

- A. Interior Wall Sleeves: 12 gage galvanized steel, flush with wall on both sides.
- B. Interior Floor Sleeves: 12 gage galvanized steel and extend 2-inches above finished floor.
- C. Exterior Wall Sleeves: Cast iron, flush with wall on both sides.
- D. On Grade Floor Sleeves: Same as exterior wall sleeves.

**2.5 ESCUTCHEONS:**

- A. Brass material, chrome plated finish. Size sufficient to cover all pipe openings through wall, floor or ceiling. Set screw or spring to secure to pipe.

**2.6 UNIONS:**

- A. Steel pipe union shall be 150-pound malleable iron, brass to iron seat, ground joint, black or galvanized to match pipe.
- B. Copper pipe union shall be 200 psig working pressure. Bronze body. Solder ends.

- C. Insulating unions shall be 250 psig working pressure. Pipe ends and material to match piping. Electric current below 1% of galvanic current. Gasket material as recommended by manufacturer. Epco or approved.

#### 2.7 ROOF FLASHING:

- A. Use flashing products specifically designed for and compatible with metal roofing system used.

#### 2.8 MISCELLANEOUS STEEL:

- A. Provide steel as required for adequate support of all mechanical equipment, angle or channel, I or H sections as required by application. Provide suitable base plates for stands and anchors for hanging equipment. Drill support holes only in flanges of structural center of length as possible. Apply one coat of black rust inhibitive enamel primer to shop fabricated items before delivery to job; other painting as specified herein. Provide shop drawings of supports especially constructed for this project. Burning of holes is not permitted.

#### 2.9 PAINTING:

- A. Apply one coat of black rustoleum primer to shop fabricated items before delivery to job. Other painting as specified herein.

#### 2.10 IDENTIFICATION MARKERS:

##### A. Pipe Markers:

1. Adhesive pipe markers of width, letter size and background color conforming to ANSI A13.1.
2. Acceptable Manufacturers: Brady B350 with banding tape. Seaton, Zeston, Porter or accepted substitute.

##### B. Nameplates:

1. Engraved nameplates, 1/16 inches thick, laminated 3-ply plastic, center ply white, outer ply black, letters formed by exposing center ply.
2. Size: 3 inches by 5 inches nameplates with 1/4-inch high letters.
3. Manufacturers: Lamicoid. Seaton, Brady, Zeston or accepted substitute.

##### C. Valve Tags:

1. 1-1/2 inches diameter, 18-gauge polished brass tags with 3/16-inch chain hole and 1/4 inch high stamped, black-filled service designation.
2. Manufacturers: Seaton Style 250-BL, Brady, Zeston or accepted substitute.

## D. Lettering and Graphics:

1. Coordinate names, abbreviations and other designations used in mechanical identification work with designations shown or scheduled. Provide numbers, lettering and wording as indicated for identification of mechanical systems and equipment.
2. Multiple Systems: Where multiple systems of same name are shown provide identification which indicates individual equipment number as well as service (examples: Chiller (CH) No. 1, Chiller (CH) No. 2, Air Conditioning Unit No. 1 (AC) No. 1, Air Conditioning Unit (AC) No. 2.)

## 2.11 VALVE SCHEDULES:

- A. Schedules: Valve schedule for each piping system, typewritten and reproduced on 8-1/2 by 11-inch paper. Indicate valve number, piping system, location of valve (room or space) and normal setting (open, closed, etc.). Mark valves which are intended for emergency shutoff and similar uses by special notation. In addition to mounted copies, furnish five (5) extra copies for maintenance manuals.

## 2.12 CONCRETE FOR MECHANICAL WORK:

- A. Provide strength classes per Building Code.

## PART 3 - EXECUTION

## 3.1 ACCESS PANELS:

- A. Furnish and install access panels required for mechanical work. Access panels shall have same fire ratings as surface where mounted. Furnish panels of adequate size for valves and equipment requiring service and installed above ceilings, behind walls or in furring, complete with correct frame for type of building construction involved. Exact size, number and location of access panels are not necessarily shown. Use no panel smaller than 12 inches by 12 inches for simple manual access or smaller than 16 inches by 20 inches where personnel must pass through. Paint with color and finish to match surrounding architectural features, where exposed.

## 3.2 PIPE SLEEVES:

- A. Sleeves: Large enough in diameter to provide 1/4-inch clearance around pipes or insulation. Caulk with watertight rated, UL listed foam-in-place barrier.
- B. Layout: Lay out work in advance of pouring of slabs or construction of wall and furnish and set inserts and sleeves necessary to complete the work.
- C. Coordination: Cutting or patching required as a result of lack of coordination of this operation shall be at no change in contract amount.

## 3.3 FLOOR, WALL AND CEILING ESCUTCHEONS:

- A. Install on piping passing through finished walls, floors, ceilings, partitions and plaster furrings. Escutcheons shall completely cover opening around pipe.
- B. Secure wall and ceiling escutcheons to pipe or structure.
- C. Escutcheons shall not penetrate insulation vapor barriers.
- D. Escutcheons not required in mechanical rooms or unfinished spaces.

### 3.4 PAINTING:

- A. General: Coordinate painting of mechanical equipment and items with products and methods specified under Section 09900, Painting.
- B. Painting Materials: material shall comply with Section 09900, Painting.
- C. Uninsulated Piping: Paint black or galvanized uninsulated piping located buried in ground, in concrete or masonry one (1) coat acid-resisting black paint. Paint black or galvanized uninsulated piping in moist equipment rooms, crawl spaces without vapor barriers or exposed to weather one (1) coat black asphaltum varnish.
- D. Iron Work: Paint hangers, rods, anchors, guides, threads of galvanized pipe, bases, supports, uncoated sheet metal and other iron work without factory finish, exposed to weather, located in moist concealed spaces and moist equipment rooms one coat acid-resisting black paint. Apply one (1) coat Dixon's Aluminum Graphite No. 209 paint over the (1) coat primer as recommended by paint manufacturer to all hot metal surfaces.
- E. Insulated Piping and Other Insulated Surfaces: Paint insulated piping in half-round, split tile, or other inaccessible locations, one (1) coat asphalt emulsion.

### 3.5 MECHANICAL SYSTEM IDENTIFICATION:

- A. Piping System: Indicate each pipe system by its generic name (abbreviated) as shown; except vent and drainage piping. Comply with ANSI A13.1 for marker locations, letter sizes, and colors. Include arrows to show direction of flow and "Electric Traced" signs to identify heat cable wrapped piping.
- B. Valve Identification: Tag all valves with brass disc and chain. Prepare valve charts indicating valve number, size, location, function and normal position. Use no duplicate numbers in Plumbing and Heating systems. Mount glazed frames containing one set of valve charts in the building as directed.
- C. Each new piece of equipment shall bear a permanently attached identification plate, listing the manufacturer's name, capacities, sizes and characteristics. In addition to the manufacturer's identification plate, provide nameplates of black phenolic resin laminate and identify new equipment by name and number ½" high letters.
- D. Mount valve schedule(s) as directed by Architect or Owner.

## 3.6 ACCESSIBILITY:

- A. Locate valves, thermometers, cleanout fittings and other indicating equipment or specialties requiring frequent reading, adjustments, inspection, repairs and removal or replacement conveniently and accessibly with reference to the finished building.
- B. Thermometers and Gages: Install thermometers and gages so as to be easily read from the floors, platforms and walkways.

## 3.7 INSTALLATION:

- A. Locating and Positioning Equipment: Comply with all Codes, Regulations and observe good common practice in locating and installing mechanical equipment and material so that completed installation presents the least possible hazard. Maintain adequate clearances for repair, service and operation to all equipment and comply with Code requirements. Set all equipment level or as recommended by manufacturer.
- B. Arrangement: Arrange ductwork and piping parallel with primary lines of the building construction, and with a minimum of 7' overhead clearance in all areas where possible. Conceal all piping and ductwork. Locate operating and control equipment properly to provide easy access. Give right-of-way to piping which must slope for drainage. Set all equipment level as recommended by manufacturer. Under no conditions shall beams, girders, footings or columns be cut for mechanical items. Casting of pipes into concrete is prohibited unless so shown on Drawings.
- C. Anchorage: Anchor and/or brace all mechanical equipment, piping and ductwork to resist displacement due to seismic action, include snubbers on equipment mounted on spring isolators.
- D. Adjusting: Adjust and calibrate all automatic mechanical equipment, mixing valves, flush valves, float devices, etc. Adjust flow rates at each piece of equipment or fixture.
- E. Building Vapor Barrier: Wherever the building insulation vapor barrier is penetrated by mechanical piping, hangers, conduits, ductwork, etc., provide clear self-adhesive tape recommended by the insulation manufacturer around the penetrations.

## 3.8 SYSTEM ADJUSTMENT:

- A. Adjust and calibrate all automatic fire suppression equipment, valves, alarm devices, etc. Open and close all shutoff and control valves several times to insure tight glands.

## 3.9 CUTTING AND PATCHING:

- A. General: Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of fire suppression work. Do all necessary cutting and patching of existing yard surfaces required for completion of the fire suppression work. Patch to match finish and color of adjacent surfaces.

END OF SECTION

## SECTION 21 0510 - PIPE AND PIPE FITTINGS

## PART 1 - GENERAL

## 1.1 WORK INCLUDED:

- A. Provide all pipe, piping fittings and all related components required for complete piping system.

## 1.2 REFERENCES:

- A. ANSI/ASME Sec. 9 – Welding and Brazing Qualifications.
- B. ANSI/ASTM B32 – Solder Metal.
- C. ANSI/AWS D1.1 – Structural Welding Code.
- D. ASME – Boiler and Pressure Vessel Code.
- E. ASTM A53 – Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- F. ASTM A120 – Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.
- G. ASTM A536 – Ductile Iron Castings
- H. ASTM F477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- I. AWS A5.8 – Brazing Filler Metal.
- J. AWWA C601 – Standard Methods for the Examination of Water and Wastewater.
- K. AWWA C606 – Standard Specification for Grooved and Shouldered Joints.

## 1.3 QUALITY ASSURANCE:

- A. Conform to ANSI/ASME B31.9 for pressurized system as well as all applicable codes.
- B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
- C. Welders Certification: In accordance with ANSI/ASME Sec 9. and ANSI/AWS D1.1.
- D. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
- E. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

## 1.4 SUBMITTALS:

- A. Submit product data under provisions of Section 21 0000 and Division 01.
- B. Include data on pipe materials, pipe fittings and accessories.
- C. Grooved joint couplings and fittings shall be shown on drawings and product submittals and shall be specifically identified with the applicable style or series designation.

## 1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver products to site under provisions of Section 21 0000.
- B. Store and protect products under provisions of Section 21 0000 and provide factory applied end caps each length of pipe and tubes to prevent damage to pipe-ends and eliminate dirt and moisture from inside of pipes and tubes.

## PART 2 - PRODUCTS

## 2.1 FIRE SPRINKLER:

- A. Pipe: Systems 10 inches or smaller, operating below 400 psi, schedule 40, standard black steel pipe ASTM A-120 or A-53.
- B. Threaded Fittings: For aboveground installations only.
  - 1. Banded class 120 cast iron fittings, ANSI B16.4 to 125 psi.
  - 2. Banded class 150 malleable iron fittings, ANSI B16.3 to 150 psi.
- C. Welded Fittings: For all underground installations, beveled ends, seamless fittings of the same type and class of piping above.
- D. Flanged Fittings: For aboveground installations only.
  - 1. Class 125 cast iron fittings, ANSI B16.2 including bolting to 125 psi.
  - 2. Class 150 steel welding neck flanges, ANSI B16.9 to 150 psi.
  - 3. Class 250 cast iron fittings, ANSI B16.1 including bolting to 250 psi.
  - 4. Facing and Gasketing: Selected for service pressures and temperatures. Full-faced for cast iron and raised face for steel flanges.
- E. Grooved Fittings: For aboveground liquid installations only, of grooved or shouldered end designed to accept grooved mechanical couplings without field preparation. UL listed and FM Global approved.
  - 1. Ductile Iron: ASTM A-536. Short-pattern with flow equal to standard fittings.
  - 2. Fabricated Steel: ASTM A-53, 3/4 inch to 1-1/2 inches Type F; 2 – 20 inches Type E or S, Grade B.
  - 3. Steel: ASTM A-234, (A-106, Gr. B) (14-24 inches 45 degree and 90 degree elbows).
  - 4. Manufacturers: Victaulic or engineer accepted substitute.

- F. Grooved Couplings for Fire Protection Services:
1. Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with NFPA-13. Couplings shall be fully installed at visual pad-to-pad offset contact. (Tongue and recess type couplings, or any coupling that requires exact gapping of bolt pads on each side of the coupling at specified torque ratings, are not allowed.)
    - a. 2 through 6 Inches: Installation-Ready, for direct stab installation without field disassembly. Victaulic Style 009-EZ.
    - b. Victaulic Firelock™ Style 005 and Zero-Flex Style 07.
  2. Flexible Type: For use in locations where vibration attenuation and stress relief are required, and for seismic applications. Victaulic Style 75 or 77.

## 2.2 MISCELLANEOUS PIPING MATERIAL:

- A. Welding Materials: Provide welding materials as determined by the installer to comply with installation requirements. Comply with Section 2-C, ASME Boiler Code for welding materials.
- B. Soldering and Brazing Materials: Provide soldering materials as determined by the installer to comply with installation requirements.
1. Tin-Antimony Solder: ASTM B32, Grade 95TA.
  2. Lead-Free Solder: ASTM B32, Grade HB. Harris "Bridgit" approved.
  3. Silver Solder: ASTM B32, Grade 96.5TS.
- C. Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast-iron flanges; raised-face for steel flanges. Pressure and temperature rating required for the service indicated.
- D. Grooved Joint Lubricants: Lubricate gaskets in accordance with the manufacturer's recommendations with lubricant supplied by the coupling manufacturer that is suitable for the gasket elastomer and system media. Standard of Acceptance: Victaulic 'Vic-Lube'.
- E. Sleeve Seal: Rubber-link pipe wall and casing closure. Thunderline Link-Seal. For fire rated wall, floor or ceiling penetrations, 3-M "CP-25" caulk, "No. 303" putty and/or "PSS 7904" sealing system.
- F. Tracer Wire: 14 gauge, single strand, copper wire with blue insulation for water, green for sanitary and storm sewers, and orange for gas. 3M "DBY" direct bury splice kit required at all splices.

## 2.3 FLANGES, UNIONS, AND COUPLINGS:

- A. Pipe Size 2 Inches and Under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.
- B. Pipe Size Over 2 Inches: 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping; neoprene gaskets for gas service; 1/16 inch thick performed neoprene bonded to asbestos.

- C. Grooved and Shouldered Pipe End Couplings: Two ductile iron housing clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion where required; “C” shape composition sealing gasket; electroplated steel bolts, nuts, and washers; galvanized couplings for galvanized pipe.
1. Steel Piping through 12 Inches:
    - a. Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.
      - 1) 2 through 6 Inches: Installation-Ready, for direct stab installation without field disassembly, with grade EHP gasket rated to +250 deg F. Victaulic Style 107.
    - b. Flexible Type: For use in locations where vibration attenuation and stress relief are required. Three flexible couplings may be used in lieu of a flexible connector. The couplings shall be placed in close proximity to the source of the vibration. Victaulic Style 77.
  2. Steel Piping 14 through 24 Inches: Victaulic AGS series with lead-in chamfer on housing key and wide width FlushSeal® gasket.
    - a. Rigid Type: Housing key shall fill the wedge shaped AGS groove and provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9. Victaulic Style W07.
    - b. Flexible Type: Housing key shall fit into the wedge shaped AGS groove and allow for linear and angular pipe movement. Victaulic Style W77.
  3. Copper Tubing, 2 through 8 Inches: Copper-tube dimensions, housings cast with offsetting angle-pattern bolt pads to provide rigidity, Installation-Ready, for direct stab installation without field disassembly, with grade EHP gasket rated to +250 deg F. Victaulic Style 607.
    - a. Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.
- D. Dielectric Connections: Union with galvanized or plated steel threaded end, grooved end, copper solder end, water impervious isolation barrier. Victaulic “Clear Flow”, Epcoc or engineer accepted substitute.
- 2.4 PIPE SLEEVES:
- A. Minimum 20 gauge galvanized steel in concrete, 18 gauge in all other construction. Provide ½-inch clearance around pipe or insulation. Provide UL approved fire-rated assemblies/caulking. 3M or accepted substitute.

## 2.5 ESCUTCHEONS:

- A. Brass material, chrome plated finish. Size to cover all pipe openings through wall, floor or ceiling. Set screw or spring to secure pipe. Coordinate all opening sizes.

## PART 3 - EXECUTION

## 3.1 PREPARATION:

- A. Ream pipe and tube ends. Remove burrs or bevel or groove plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges, grooved joint couplings, or unions.

## 3.2 INSTALLATION:

- A. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Route piping in orderly manner, maintain gradient and conceal all piping unless otherwise indicated.
- C. Install piping to conserve building space, not to interfere with use of space or access panels and parallel with walls.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Provide loops, swing joints, pinchers, runouts and spring pieces to prevent damage to piping or equipment:
  - 1. For water systems, use adequate numbers of Victaulic Style 77 flexible couplings in header piping to accommodate thermal growth and contraction, and for the elimination of expansion loops. (In accordance with Victaulic instructions and as approved by the engineer.) Where expansion loops are required, use Victaulic Style 77 couplings on the loops.
- F. Provide clearance for installation of insulation and access to valves and fittings.
- G. Slope piping and arrange to drain at low points and provide drain valve.
- H. Establish elevations of buried water piping outside the building to ensure not less than 3 feet of cover.
- I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- J. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting. Refer to Section 21 0500.

- K. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)
- L. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients.
- M. Pitch vent piping at 1/4 inch per 10 feet minimum.
- N. Establish elevations of all heating and cooling piping to ensure minimum of 1 inch pitch for every 40 feet to low point drip or drains:
1. Unions and flanges for dismantling are not required in installations using grooved mechanical joint couplings. (The couplings shall serve as unions and disconnect points.)
- O. Unions and Flanges: At all equipment to permit dismantling and elsewhere as consistent with good installation practice.
- P. Tracer Wire: Provide tracer wire as close to underground non-metallic water, sanitary and storm sewers and gas pipe in the trench as possible. Tracer wire shall be accessible at grade via all services, valve and meter boxes, curb cocks, cleanouts at the building, manholes (inside the cover near the top), etc. Locate all points on the record as-installed drawings. Splice into utility tracer system where available. Comply with code requirements.
- Q. Corrosion Control Underground Steel Piping Corrosion Protection: Factory wrap all uninsulated underground steel piping systems with protective coating composed of a coal-tar saturated wrapping tape over a 20 mil thick coal-tar epoxy coating. Wrap joints with a minimum of 1/2 width of wrap. Extend wrap not less than 4-inches above grade.
- R. Pipe Sleeves: Lay out work in advance of pouring concrete and furnish and set sleeves necessary to complete work.
1. Floor Sleeves: Provide sleeves on pipes passing through concrete construction. Extend sleeve 2-inches above finished floor. Caulk all pipes passing through floor with non-shrinking grout or approved caulking compound. Provide Link-Seal sleeve sealing system for slab on grade. Caulk/seal all piping passing through fire rated building assemblies with UL rated assemblies. Provide fire-rated assemblies per local code requirements.
  2. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk all pipes passing through walls with non-shrinking caulking compound. Caulk/seal all piping passing through fire rated building assemblies with UL rated assemblies. Provide fire-rated assemblies per local code requirements.

- S. Expansion and Flexibility: Install all work with due regard for expansion and contraction to prevent damage to piping, ductwork, equipment, building and its contents. Provide piping offsets, loops, approved type expansion joints, anchors or other means to control piping movement and to minimize pipe forces.
  - 1. For water systems, use adequate numbers of Victaulic Style 77 flexible couplings in header piping to accommodate thermal growth and contraction, and for the elimination of expansion loops. (In accordance with Victaulic instructions and as approved by the engineer.) Where expansion loops are required, use Victaulic Style 77 couplings on the loops.
- T. Escutcheons: Install on all exposed pipes passing through wall or floors and on fixture stops and waste connections to wall.
- U. Where piping is installed in the exterior building envelope or in any component of the exterior building envelope it shall be located on the warm building interior side of the building envelope insulation.

### 3.3 CLEANING:

- A. General: Clean all dirt and construction dust and debris from all fire suppression piping systems and leave in a new condition. Touch up paint where necessary.

### 3.4 TEST:

- A. General:
  - 1. Minimum duration of two hours or longer, as directed for all tests. Furnish report of test observation signed by qualified inspector. Make all tests before covering, backfilling, or otherwise concealing piping or connecting equipment. Where part of the system must be tested to avoid concealment before the entire system is complete, test that portion separately, same as for entire system.
- B. Fire Sprinkler Piping: 75 psig hydrostatic for 30 psig systems without loss for four hours.

END OF SECTION

## SECTION 21 0523 - VALVES

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED:

- A. The requirements of this Section apply to the valving for the systems specified elsewhere in Division 21.

#### 1.2 QUALITY ASSURANCE:

- A. Provide valves from a single manufacturer where possible with manufacturer's name and pressure rating marked on valve body.
- B. Valve size shall be the same as connecting pipe size unless otherwise noted.

#### 1.3 SUBMITTALS:

- A. Submit product data under provisions of Section 21 0000.
- B. Include data on valves and accessories.

### PART 2 - PRODUCTS

#### 2.1 BALL, CHECK, STOP CHECK, NON SLAM CHECK, BUTTERFLY, GATE TYPES:

- A. Manufacturers: Crane, ITT, Grinnell, Hammond, Jenkins, Kennedy, Mueller, Lunkenheimer, Milwaukee, Nibco, Powell, Stockham, Walworth, Legend or accepted substitute. Grooved end valves Victaulic, Gustin-Bacon or accepted substitute. Grinnell numbers are given except as noted.
- B. Fire Sprinkler Systems:
  - 1. Valves 2 inches and smaller:
    - a. Ball, Fig. 3500. 125 psi, bronze body, full port.
    - b. Check, Fig. 3300. Class 125, bronze body, horizontal swing.
    - c. Gate, Fig. 3050. 150 psi, bronze body, non-rising stem.
  - 2. Valves 2 inches and larger:
    - a. Butterfly (<200 deg. F), Fig. 8000. 150 psi cast iron body.
    - b. Check, Fig. 6300 A. Class 125, cast iron body, horizontal swing.
    - c. Gate, Fig. 6020 A. Class 125, cast iron body, non-rising stem.
    - d. Globe, Fig. 6200 A. Class 125, cast iron body, renewable seat, bronze mounted.

## 2.2 DOUBLE CHECK BACKFLOW PREVENTER:

- A. Provide a double check valve assembly complete with isolation valves, check module assembly, test cocks, and strainer. USC Foundation for Cross Connection Control, State Health officials and serving utilities approved. Bronze bodies on units 2 inches and smaller and cast iron bodies with bronze trim on units 2-1/2 inches and larger.
- B. Manufacturers: Febco, Conbraco, Wilkins, Watts or accepted substitute.

## PART 3 - EXECUTION

## 3.1 INSTALLATION:

- A. Provide clearance for installation of insulation and access to valves and fittings.
- B. Provide access where valves and fittings are not exposed. Coordinate size and location of access door with Section 21 0000.
- C. Install valves with stems upright or horizontal, not inverted.
- D. Provide one plug cock wrench for every five plug cocks sized 2 inches and smaller. Provide each plug cock sized 2-1/2 inches and larger with a wrench with set screw.
- E. Fluid Control: Install gate, ball, globe, plug, and butterfly valves to comply with ANSI B31. Install check valves where indicated and where flow reversal is obviously not desirable and can be reasonably expected to occur, including piping at the discharge of pumps.
- F. Application: Valve type and style as shown on the Drawings. Where style is not indicated, use the following:
  - 1. Fire Sprinkler: Use gate valves in mechanical and/or boiler rooms and globe valves for throttling service.
  - 2. Use non-rising stem gate valves.

END OF SECTION

## SECTION 21 0529 - SUPPORTS AND ANCHORS

## PART 1 - GENERAL

## 1.1 WORK INCLUDED:

- A. Provide pipe and equipment hanger, support, anchors and all related items for complete systems.

## 1.2 QUALITY ASSURANCE:

- A. Supports for sprinkler piping and standpipes: In conformance with NFPA 13 and 14.
- B. Provide pre-manufactured horizontal piping hangers, clamps, hanger rod, shields, supports, etc.
- C. Seismic requirements: Provide seismic restraints in accord with the latest edition of "Seismic Restraint Manual Guidelines" as published by SMACNA. Seismic Hazard Level (SHL) of "A". A lower SHL will be allowed provided the contractor provides calculations stamped by a registered professional structural engineering in the state the project is located indicating a lower SHL is acceptable.

## 1.3 SUBMITTALS:

- A. Submit product data under provisions of Section 21 0000.
- B. Submit construction details, and performance characteristics for each type and size of anchor, hanger and support.

## PART 2 - PRODUCTS

## 2.1 HANGERS AND SUPPORTS:

- A. Listed Types: The Manufacturers Standardization Society (MSS) Piping Types listed with Grinnell figure numbers in parentheses where applicable (or another manufacturer's as noted). ITT Grinnell, Elcen, Michigan, Super Strut, Kindorf, Unistrut or accepted substitute.
- B. Horizontal Piping Hangers and Supports:
  - 1. Adjustable Clevis Hanger: MSS Type 1 (Fig. 260).
  - 2. Adjustable Band Hanger: MSS Type 7 (Fig. 97), fabricated from steel.
  - 3. Adjustable Swivel-Band Hanger: MSS Type 10 (Fig.70).
  - 4. Clamp: MSS Type 4 (Fig. 212, 216).
  - 5. Double-Bolt Clamp: MSS Type 3 (Fig. 295A, 295H), including pipe spacers.
  - 6. Pipe Anchors: (Carpenter & Peterson Fig. 145CI) Steel weld type to pipe for sizes up to 20 inches in diameter.

7. Adjustable Saddle-Support: MSS Type 36 (Fig. 258) and MSS Type 37 (Fig. 259), including saddle, pipe and reducer. Fabricate base-support from steel pipe and include cast-iron flange or welded-steel plate.
- C. Equipment and Piping Supports:
1. Channel Support System: Galvanized, 12 gauge channel and bracket support systems, single or double channel as indicated on the Drawings or as required by piping and equipment weights. Grinnell "Power "Strut" channel.
  2. Steel Brackets: Welded structural steel shapes complying with one of the following:
    - a. Light Duty: MSS Type 31 (Fig. 194).
    - b. Medium Duty: MSS Type 32 (Fig. 195).
    - c. Heavy Duty: MSS Type 33 (Fig. 199).
- D. Vertical Pipe Clamps:
1. Two-Bolt Riser Clamp: MSS Type 8 (Fig. 261).
  2. Four-Bolt Riser Clamp: MSS Type 42 include pipe spacers at inner bolt-holes.
- E. Hanger Rod Attachment:
1. Hanger Rod: Right hand threaded, (Grinnell Fig. 140 or 146 for all sizes).
  2. Turnbuckles: MSS Type 13 (Fig. 230).
  3. Weldless Eye-Nut: MSS Type 17 (Fig. 290).
  4. Malleable Eye-Socket: MSS Type 16 (Fig. 110R).
  5. Clevises: MSS Type 14 (Fig. 299).
- F. Building Attachments:
1. Concrete Inserts: MSS Type 18 (Fig. 282), steel or Grinnell Power-Strut PS349 continuous channel.
  2. Clamps: MSS Type 19 (Fig. 285, 281), Type 20, 21 (Fig. 225, 226, 131), Type 23 (Fig. 86, 87,88), Type 25 (Fig. 227), Type 27 through 30 where applicable.
- 2.2 SADDLES AND SHIELDS:
- A. Listed Types: The Manufacturers Standardization Society (MSS) Piping Types listed with Grinnell figure numbers in parentheses where applicable (or another manufacturer's as noted).
  - B. Protection Saddles: MSS Type 39 (Fig. 160).
  - C. Protection Shields: MSS Type 40 (Fig. 167).
- 2.3 MISCELLANEOUS HANGER MATERIALS:
- A. Metal Framing: Provide products complying with NEMA STD ML 1.
  - B. Steel Plates, Shapes and Bars: ASTM A-36.

- C. Cement Grout: Portland Cement (ASTM C-150, 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 only the minimum amount of water required for placement and hydration.
- D. Heavy Duty Steel Trapezes: Fabricate from steel shapes selected for the loads required; weld steel in accordance with AWS Standards.
- E. Pipe Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of a bolted two-section outer cylinder and base with a two-section guiding spider bolted tight to the pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of the length recommended by the manufacturer to allow indicated travel.
- F. Standard Bolts and Nuts: ASTM A 307, Grade A.
- G. Concrete Anchors: Rawl Lok/Bolt, Hilti "HSL," ITT Phillips, Red Head Wedge Anchors, Ramset Trubolt or Dynabolt or accepted substitute.
- H. Shop Primer: Manufacturer's standard rust inhibitive primer.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF HANGERS AND SUPPORTS:

- A. General: Proceed with the installation of hangers, supports and anchors only after the required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) the proper placement of inserts, anchors and other building structural attachments.
  - 1. Install hangers, supports, clamps, and attachments to support piping and equipment properly from the building structure. Use no wire or perforated metal to support piping, and no supports from other piping or equipment. For exposed continuous pipe runs, install hangers and supports of the same type and style as installed for adjacent similar piping.
  - 2. Support fire sprinkler piping independently of other piping and in accordance with NFPA Pamphlet 13.
  - 3. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at panel points only.
  - 4. Install hangers and supports to provide the indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded. Comply with the following installation requirements:
    - a. Clamps: Attach clamps, including spacers (if any), to piping outside the insulated piping support. Do not exceed pipe stresses allowed by ANSI B31.
    - b. Load Rating: All insulated pipe supports shall be load rated by the manufacturer based upon testing and analysis in conformance with ASME B31.1, MSS SP-58, MSS SP-69 and MSS SP-89.
    - c. Support Type: Manufacturer's recommendations, hanger style and load shall determine support type.

B. Provisions for Movement:

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units.
2. Install hangers and supports so that equipment and piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

C. Pipe Hangers and Supports:

1. Vertical Spacing: Support at base, every floor height not exceeding 10 feet and required by Code and just below roof line.
2. Screwed or Welded Steel or Copper Piping: Maximum hanger spacing shall be as follows:

	Steel	Copper
1-1/4 inches and smaller	6 foot span	5 foot span
1-1/2 inch pipe	9 foot span	6 foot span
2 inch pipe	10 foot span	10 foot span
2-1/2 inch	11 foot span	10 foot span
4 inches and larger	12 foot span	10 foot span

3. Install additional hangers or supports at concentrated loads such as pumps, valves, etc. to maintain alignment and prevent sagging.
4. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
5. Place a hanger within 12 inches of each horizontal elbow.
6. Support Rod: Hanger support rods sized as follows:

Pipe Size	Rod Diameter	Max. Load
2 inches and smaller	3/8 inch	610 lb.
2-1/2 to 3 inches	1/2 inch	1130 lb.
4 inches	5/8 inch	1810 lb.
6 inches	3/4 inch	2710 lb.
8 through 12 inches	7/8 inch	3770 lb.

D. Adjust hangers and supports to bring piping to proper levels and elevations.

E. Provide all necessary structural attachments such as anchors, beam clamps, hanger flanges and brackets in accordance with MSS SP-69. Attachments to beams wherever possible. Supports suspended from other piping, equipment, metal decking, etc., are not acceptable.

F. Horizontal banks of piping may be supported on common steel channel member spaced not more than the shortest allowable span required on the individual pipe. Maintain piping at its relative lateral position using clamps or clips. Allow lines subject to thermal expansion to roll axially or slide. Size channel struts for piping weights.

## 3.2 INSTALLATION OF ANCHORS:

- A. Install anchors at the proper locations to prevent stresses from exceeding those permitted by ANSI B31, where recommended in SMACNA "Seismic Restraint Manual" or exceeding manufacturer's recommended loading, and to prevent the transfer of loading and stresses to connected equipment.
- B. Welding: Provide anchor by welding steel shapes, plates and bars to the piping and/or equipment and to the structure. Comply with ANSI B31 and AWS standards and SMACNA "Seismic Restraint Manual."
- C. Bolting: Provide standard plate washers under heads and nuts of bolts bearing on wood. Soap threads of lag bolts prior to installing.
- D. Structural Blocking: Locate as indicated and as required to support mechanical piping and equipment.
- E. Where expansion compensators are indicated, install anchors in accordance with the expansion unit manufacturer's written instructions, to limit movement of piping and forces to the maximums recommended by the manufacturer of each unit.
- F. Anchor Spacings: Install anchors at the ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends. Make provisions for presetting of anchors as required to accommodate both expansion and contraction of piping.
- G. Painting: Refer to Section 21 0000.

END OF SECTION

## SECTION 21 1300 - FIRE PROTECTION

## PART 1 - GENERAL

## 1.1 WORK INCLUDED:

- A. Provide all labor and material for the design and installation of modifications and extensions of existing building system for a complete and operating automatic sprinkler system for new tenant space.

## 1.2 SYSTEM DESCRIPTION:

- A. System to provide coverage for tenant space including attic space, ceiling space, overhangs and covered areas and as required by governing agency.
- B. Provide system to NFPA 13 occupancy requirements. Final occupancy hazard designation in accord with the governing agency requirement.
- C. Revisions to the Contractor's design required by the governing agency shall be at the Contractor's expense.

## 1.3 QUALITY ASSURANCE:

- A. Installation to conform to NFPA 13.
- B. Equipment and Components: Bear UL and/or FM label as per governing agency.
- C. Specialist Firm: Established fire protection company regularly engaged and specializing in design and installation of fire sprinkler systems.
- D. Provide pumps with manufacturer's name, model number, and rating/capacity.
- E. Test of all equipment, components and controllers shall be in accordance with NFPA.
- F. Governing Agency: All work in accordance with and accepted by the following hereafter referred to Governing Agencies:
  - 1. All reviewing authorities including State Fire Marshal, local Fire Marshal, owner's insurance underwriters, owner's representative and any other reviewing agency whose approval is required to obtain occupancy.
- G. Field Wiring: Comply with requirements of Section 21 0000.
- H. Work of Other Trades: Comply with requirements of Section 21 0000.

**1.4 REGULATORY REQUIREMENTS:**

- A. Product Data, Shop Drawings, and Low Water Pressure Cut-in Controller: Bear stamp of approval of authority having jurisdiction, Fire Marshal and Owner's fire insurance underwriter.

**1.5 SUBMITTALS:**

- A. Submittals:
  - 1. Sprinkler Heads: Product Data and sample of each type of head.
  - 2. Alarm flow switches.
  - 3. Fire department connection.
  - 4. Double check valve assembly.
  - 5. Miscellaneous Equipment.
  - 6. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, components and accessories.
  - 7. Indicate pump type, capacity, power requirements, affected adjacent construction.
  - 8. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
- B. Test Reports: Submit certificates of completion of tests and inspections.

**1.6 PROJECT RECORD DOCUMENTS:**

- A. Submit documents under provisions of Section 21 0000.

**1.7 OPERATION AND MAINTENANCE DATA:**

- A. Submit manufacturer's operation and maintenance data under provisions of Section 21 0000.
- B. Include written maintenance data on components of system, servicing requirements and Record Drawings.
- C. Include pump operation, maintenance, and inspection data, replacement part numbers and availability, and location and numbers of service depot.

**1.8 DELIVERY, STORAGE, AND HANDLING:**

- A. Deliver and store all equipment and components in shipping containers with labelling in place under provisions of Section 21 0000.
- B. Provide temporary inlet and outlet caps.
- C. Maintain caps in place until installation.

## 1.9 EXTRA STOCK:

- A. Provide extra sprinkler heads under provisions of NFPA 13.
- B. Provide suitable wrenches for each head type.
- C. Provide metal storage cabinet with extra heads and wrenches in location approved by the Architect. Also, provide a list of heads stored within and brief description of where installed.
- D. Where applicable, provide one set of gaskets and screens for each pump type and model supplied for Owner's use.

## PART 2 - PRODUCTS

## 2.1 PIPING MATERIALS:

- A. Underground Water Piping: Ductile cast iron water pipe; ANSI A-21.51; with mechanical joints, ANSI A-21.10 and ANSI A21.11; and with concrete thrust blocks.
- B. Aboveground Water Piping: Use standard weight black steel pipe and cast iron screwed or mechanical joint fittings especially adapted for sprinkler work and suitable for 175 pounds working pressure. Use reducing fittings where changes in pipe size occur. Bushings are prohibited. All sprinkler specialty material Grinnell, Star, Viking, Automatic Sprinkler Corp. of America acceptable substitute, with UL and FM approval for the specific use in system.
- C. At Contractor's option, where approved by the governing agency, thin-wall steel pipe ASTM A53-76, and mechanical joint fittings specifically approved for sprinkler work, suitable for minimum 175 pounds working pressure may be substituted for the black steel pipe specified above.

## 2.2 MATERIALS AND EQUIPMENT:

- A. Sprinkler Heads: Approved heads with temperature ratings required for service indicated.
  - 1. Unfinished Areas: Glass bulb, upright, pendent or sidewall spray type, plain bronze.
  - 2. Finished Areas: Glass bulb, chrome plated semi-recessed and sidewall heads in finished ceilings and where piping is exposed use chrome plated upright heads.
  - 3. Dry Pipe Systems: Glass bulb, especially designed and approved for dry pipe systems except where piping is routed through heated areas, standard heads may be utilized as approved by the Governing Agency.
- B. Escutcheons: Provide white escutcheons on pipe extending through finished walls and ceilings.
- C. Valve Monitoring Switches: Provide approved monitoring switches where shown on the Drawings or required by Governing Agency. Provide through the wall post indicator valves.
- D. Valves: Iron body OS&Y pattern, bronze mounted double disc, parallel seat.
- E. Guards: Standard manufacture. Grinnell, Marlboro or acceptable substitute.

- F. Fire Department Connection: Flush wall mounted cast brass construction with clappers on each inlet and threads match the fire district equipment. Number of inlets and sizes as indicated on the Drawings and approved by the fire district. Standard, Allenco, Seco, Potter-Roemer or accepted substitute.

### PART 3 - EXECUTION

#### 3.1 PREPARATION:

- A. Coordinate work of this Section with other affected work.

#### 3.2 EXAMINATION:

- A. Examine walls for suitable conditions where cabinets, risers, drain valves, etc. are to be installed.
- B. Do not proceed until unsatisfactory conditions have been corrected.

#### 3.3 INSTALLATION:

- A. Place pipe runs to minimize obstruction to other work.
- B. Place piping in concealed spaces unless otherwise noted.
- C. Apply strippable tape or paper cover to ensure concealed sprinkler head cover plates do not receive field paint finish.
- D. Hangers and Supports: Comply with the requirements of NFPA 13 and NFPA 14. Hanger and support spacing and locations for piping joined with grooved mechanical couplings shall be in accordance with the grooved mechanical coupling manufacturer's written instruction for rigid systems. Provide protection from damage where subject to earthquake in accordance with NFPA 13.
- E. Make connections between underground and aboveground piping using an approved transition piece strapped or fastened to prevent separation.
- F. Install mechanical sleeve seal at pipe penetrations in basement and foundation walls. Refer to 15050-2.3 Section "Basic Piping Materials and Methods".
- G. Install test connections sized and located in accordance with NFPA 13 complete with shutoff valve. Test connections may also serve as drainpipes.
- H. Install pressure gauge on the riser or feed main at or near each test connection. Provide gauge with a connection not less than 1/4 inch and having a soft metal seated globe valve arranged for draining pipe between gauge and valve. Install gauges to permit removal and where they will not be subject to freezing.

- I. Locate sprinkler heads in repeating, modular pattern, centered and accurately coordinated with ceiling grid as indicated. Conceal all piping unless indicated otherwise. Coordinate design with lighting and exposed HVAC duct layout in areas without ceilings.
- J. Locate and install the required fire sprinkler alarm, flow, and test and drain valves where required by the Governing Agency and approved by the Architect.

#### 3.4 FIELD QUALITY CONTROL:

- A. Flush, test and inspect sprinkler piping systems in accordance with NFPA 13.
- B. Replace piping system components which do not pass the test procedures specified and retest repaired portion of the system.
- C. Perform other tests as directed by Governing Agency.

#### 3.5 CLEANING:

- A. Flush entire piping system of foreign matter.

#### 3.6 SYSTEM TESTS:

- A. Test entire system per code and per requirements of local authority. Provide, arrange and pay for all testing required in order to obtain temporary and final acceptance. Witness tests by local authority and Architect. Notify local authority and Architect one week prior to test.

#### 3.7 PAINT:

- A. Paint all exposed piping and hangers in accordance with Section 15050. Do not paint heads.

#### 3.8 CERTIFICATE OF COMPLETION:

- A. Obtain and deliver to Owner a certificate, in duplicate, stating that system as installed has been inspected and accepted by authorities and/or agencies having jurisdiction, and that all regulations affecting work have been satisfied. Submit and acceptable certificate to the Owner before final payment is requested.
- B. Certificate: Minimum NFPA Form 85 information.

END OF SECTION

DIVISION 22 MASTER PLUMBING SPECIFICATION

SECTION 220000	GENERAL PROVISIONS
SECTION 220300	PLUMBING
SECTION 220500	BASIC MATERIALS AND METHODS
SECTION 220510	PIPE AND PIPE FITTINGS
SECTION 220523	VALVES
SECTION 220529	SUPPORTS AND ANCHORS
SECTION 220700	MECHANICAL INSULATION

## SECTION 22 0000 - GENERAL PROVISIONS

## PART 1 - GENERAL

- 1.1 GENERAL REQUIREMENTS: Drawings and general provisions of the Contract, including General and other conditions and Division 01 General requirements Sections apply for the work specified in this Section.
- 1.2 SCOPE OF WORK: The work covered by this Specification shall include furnishing all labor, materials, equipment and services to construct and install the complete plumbing system as shown on the Drawings and specified herein. Verify all conditions on the job site and lay out work accordingly.
- 1.3 RELATED WORK:
- A. The General Provisions apply to this Division, including but not limited to:
1. Drawings and Specifications.
  2. Contract Modifications, addendums and change orders.
- B. Division 1, General Requirements, applies to this Division, including but not limited to:
1. Summary of Work.
  2. Coordination. In addition, it shall be the responsibility of each trade performing work specified under Division 22 to coordinate with all others for proper and adequate installation clearance.
  3. Cutting and Patching. The cost of cutting and patching required work of Division 22 and not shown in other Divisions of Work shall be included in the cost of Division 22.
  4. Shop Drawings, Product Data and Samples.
  5. Temporary Facilities and Controls.
  6. Material and Equipment.
  7. Substitutions and Product Options.
  8. Contract Closeout:
    - a. Project Record Documents. Keep up to date marked up Drawings on site.
    - b. Operations and Maintenance Data.
    - c. Start-up.
- C. Related work provided in Divisions 02 through 14:
1. Pipe chases and formed concrete work except as specified hereunder.
  2. Framed openings in masonry, concrete, wood and other architectural and structural elements.
  3. Wood grounds and nailing strips in masonry and concrete.
  4. Installation only of access panels in ceilings, walls, etc. Provide access panels as part of mechanical work.
  5. Painting except as specified hereunder.

6. Curbs and roof flashings for openings through roofs, except for roof drain and vent pipe flashing.

D. Related Work provided in Division 26 and 28:

1. Motor disconnect switches and installation except as specified herein.
2. Motor starters and installation except as herein specified.
3. Power wiring except as specified herein.

1.4 QUALITY ASSURANCE:

A. Regulatory Requirements:

1. All work, installations, materials and equipment shall comply with the provision of the following codes, standards and regulations, except where more stringent requirements are shown or specified:
  - a. State of Oregon Plumbing Specialty Code. (UPC)
  - b. State of Oregon Structural Specialty Code. (IBC)
  - c. National Electrical Code. (NEC)
  - d. National Fire Protection Agency. (NFPA)
  - e. All City, County, State and Federal applicable laws and regulations.
  - f. Regulations and standards set forth by ASME, ASHRAE, SMACNA, AGA and ARI.
2. Should there be any direct conflict between Codes and the Drawings and Specifications, the Codes, rules and regulations shall govern.
3. Where two or more codes or regulations apply, the more stringent of the two shall be exercised.
4. Should the Documents indicate a condition, which will conflict with the Codes, the Contractor shall inform the Owner's Representative and refrain from installing that portion until resolved. Any work installed in violation of the Codes will be removed and correctly installed as part of the Contract work.
5. If the Drawings and Specifications indicate a higher quality than code, the Drawings and Specifications shall govern.
6. Electrical products shall bear the U.L. label.

B. The entire plumbing system shall operate correctly at full capacity without objectionable noise, vibration or decrease of efficiency.

C. Materials and Equipments:

1. Equipment furnished shall meet all requirements of the Drawings and Specifications and be suitable for the installation. Equipment not meeting all requirements will not be acceptable.
2. Where two or more units of the same class of equipment are furnished, use products of the same manufacturer.
3. Furnish all materials and equipment, new and of size, type and quality herein specified.

- D. Workmanship:
  - 1. Follow manufacturers' instructions. If they are in conflict with the Drawings and Specifications, obtain clarification from the Architect prior to beginning the work.
- E. Cutting and Patching:
  - 1. Provide for cutting, patching and repairing for the installation of the work specified, including masonry work, concrete work, carpentry work and painting. Work shall be performed by skilled craftsmen of the respective trade.

#### 1.5 DRAWINGS:

- A. The Drawings and Specifications are complementary and what is called for by one shall be as if called for by both. All items shown on the Drawings are not necessarily included in the Specifications. All directives and instructions to furnish, provide, install, complete and test described in the design documents shall be interpreted as directives unless clearly specified otherwise.
- B. Bring obscure or questionable items to the attention of the Owner's Representative prior to bid date. Necessary directions and explanations will be given by the Owner's Representative in Addendum Form.
- C. Should the Documents indicate a condition which will conflict with the Governing Codes and Regulations, the Contractor shall refrain from installing that portion of the work until receiving verification from the Owner's Representative. Should rearrangement or rerouting of duct or piping be necessary, provide for approval the simplest layout possible for that particular portion of the work. Any work installed in violation of the Governing Codes will be removed and correctly installed by the Contractor as part of the Contract work.
- D. Drawings are diagrammatic. They do not show every offset, bend, tee, or elbow which may be required to install work in the space provided. Do not scale drawings for roughing-in measurements, nor use as shop drawings. Make field measurements and prepare shop drawings as required. Coordinate work with shop drawings of other trades. Provide any bends, offsets and elbows where required by local conditions from measurements taken at the Building (subject to approval) and without additional cost to the Project. The right is reserved to make any reasonable changes in outlet location prior to rough-in.
- E. It is the intent of these specifications that the field wiring of all systems provided and modified under this contract shall be complete and operable. Refer to all drawings and specifications, especially the electrical drawings, to determine voltage, phase, circuit ampacity and number of connections indicated. Bring to the attention of the Engineer all conflicts, incompatibilities and discrepancies prior to bid.
- F. Where equipment is shown, dimensions have been taken from typical equipment of the class indicated. Carefully check the Drawings to see that the equipment under consideration for installation will fit the space provided and that all connections may be made thereto without impairment of space and height requirements and of Code required clearances. Contractor is responsible for all changes required by equipment dimensions different than those shown.

- G. Where equipment manufacturer and model number are listed it is the most recent and/or desired to describe function and quality of equipment to be supplied and installed. Since manufacturers may change model numbers without notification, should the model specified be unavailable, furnish and install the model number that is equal to or better than the one listed.
- H. The location of all utilities, wires, conduits, pipes, duct, or other service facilities are shown in a general way only on the Drawings and are taken from existing public records. Ascertain whether any additional facilities other than those shown on the plans may be present and determine the exact location and elevations of all utilities prior to commencing installation.
- I. Prior to bid, contact the local utility companies to verify requirements. Provide all material and labor by utilities.
- J. The Contractor, before submitting a Bid on the work, must visit the site to become familiar with all visible existing conditions. As a result of having visited the premises, the Contractor shall be responsible for the installation of the work as it relates to such visible existing conditions. The submission of the bid will be considered an acknowledgement of the part of the Bidder of visitation to the site.
- K. The Contractor is responsible to apply for and obtain all necessary permits, fees and inspections required by any public authority having jurisdiction. Refer to General Conditions for additional information.

#### 1.6 SUBSTITUTION AND PRODUCT OPTIONS:

- A. See Division 01.
- B. The use of manufacturer's names, models and numbers in the Drawings and Specifications is intended to establish style, quality, appearance and usefulness. The model numbers listed are the last available to the designer, if no longer current, substitute equipment equal to or better than that represented by the model number listed. Items noted "or equivalent" will require prior acceptance.
- C. Submit for the Owner's Representative's review, manufacturer's detailed specifications and data sheets for all proposed substitutions. Submittals shall consist of a single sheet, or specific data need for consideration of approval. All pertinent data listed in the Specifications and on the Drawings shall be furnished, including all special features. See that all submittals are in proper order, and that all equipment will fit the space provided.
- D. All requests for approval of substitutions for materials other than those specified must be submitted in accordance with Instruction to Bidder.
- E. Substitution products from approved manufacturers do not need prior approval. Ensure substitutions meet all requirements of the Specifications.
- F. All changes required due to product substitutions are the responsibility of the Contractor.

## 1.7 PROJECT RECORD DRAWINGS:

- A. Obtain drawings from Architect.
- B. Keep Drawings clean, undamaged and up to date.
- C. Record and accurately indicate the following:
  - 1. Depths, sizes and locations of all buried and concealed piping.
  - 2. Locations of all clean-outs.
  - 3. Changes, additions and revisions due to contract modifications.
  - 4. Locations of tracer wire terminal points.
- D. Drawings to be available for Architect review.
- E. Submit as a part of Project Closeout Documents

## 1.8 PROJECT CONDITIONS:

- A. Existing Conditions: Prior to bidding, verify and become familiar with all existing conditions by visiting the site and include all factors which may affect the execution of this work. Include all related costs in the initial bid proposal.
- B. Coordinate exact requirements governed by actual job conditions. Check all information and report all discrepancies before fabrication work. Report changes in the time to avoid unnecessary work. Make changes as directed by Owner's Representative.

## 1.9 CONTRACT MODIFICATIONS:

- A. In addition to the requirements of the General provisions, all supplemental cost proposals for this Division of work shall be accompanied by a complete itemized breakdown of labor and materials for each item. No exceptions will be made. Contract's estimating sheets for supplemental cost proposals shall be made available upon request. Labor must be separated and allocated to each item of work. Changes or additions subject to additional compensation made without written authorization based on agreed price shall be at Contractor's own risk and expense.

## 1.10 STORAGE AND HANDLING:

- A. Delivery: Deliver to project site with manufacturer's labels intact and legible.
- B. Handling: Avoid damage.
- C. Storage: Store material inside, protected from weather, dirt and construction dust. Where necessary to store outside, elevate well above grade and enclose with durable, waterproof wrapping.

## 1.11 WARRANTY:

- A. Provide a written guaranty covering the work of this Division for a period of one calendar year from the date of acceptance of the entire project as required by the General Provisions.
- B. Provide manufacturer's written warranties for material and equipment furnished under this Division insuring parts and labor for a period of one year from the date of acceptance of the entire project.
- C. Correct warranty items promptly upon notification.

## 1.12 OPERATIONS AND MAINTENANCE DATA:

- A. Prior to final inspection, provide three (3) copies of manufacturer's maintenance manuals for each piece of equipment or items requiring service. Manual shall include manufacturer's operation and maintenance instruction manuals and parts list for each piece of equipment or item requiring servicing. Include in the manual manufacturer's service data, wiring diagrams and parts lists for all major items of equipment, valve charts, balancing data and any additional equipment added by contract modification. Comply with provisions of Section 01700 where applicable.
- B. Submit bound in 8-1/2 x 11 inch text pages, three ring binders with durable plastic covers.
- C. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
- D. Internally subdivide the binder contents with permanent page dividers, logically organized with tab titling clearly printed under reinforced laminated plastic table.

## 1.13 SUBMITTALS:

- A. Shop Drawings: The Contract Drawings indicate the general layout of the piping and various items of equipment. Prepare and submit for review Shop Drawings of all installation not detailed on the Contract Drawings and all changes to the Contract Drawings.
- B. Product Data:
  - 1. Submit for review manufacturer's detailed shop drawings, specifications and stat sheets for all equipment to be furnished, as well as any wiring diagram showing field installed wiring and devices. Arrangement of plumbing equipment has been based on items of specific manufacturer intended as somewhat typical of several makes, which may be approved.
  - 2. Indicate construction, capacities, accessories, etc. Manufacturer's abbreviations or codes are not acceptable.
  - 3. List the name of the motor manufacturer for each piece of equipment.

## C. Submission Requirements:

## 1. Shop Drawings and Product Data:

- a. Submit all equipment and product data for Work of Division 22 together in a group in a 3-ring loose-leaf binder, with each item filed under a tab, and labeled with its respective specification section number, article and paragraph, and mark if applicable.
- b. Include a complete index in the original submittal. Indicate both original items submitted and note stragglers that will be submitted at a later date to avoid delay in submitting.
- c. Additional product data submitted after return of the original binder shall include a tab similar to the originally submitted. Upon receipt of the return submittal, insert them in the previously submitted binder.
- d. Refer to Division 01 for number of shop drawing copies to be submitted.
- e. Indication of unit, model, features, etc being submitted must be marked by bold arrow, bold circle or other clear means that will reproduce in black and white. Use of highlights, colored text or other colored indicators cannot be used.

2. Sample: Submit samples required by each Section of Division 22 at the same time that shop drawings and product data are submitted.

## D. It shall be the Contractor's responsibility to:

1. See that all submittals are in proper order.
2. Ensure that all equipment will fit in the space provided.
3. Assure that all deviation from Drawings and Specification are specifically noted and called to the attention of the Engineer/Architect/Contracting Officer in the submittals. Failure to comply will void approval automatically.
4. Deviation, discrepancies, and conflicts between the submittals and the contract documents discovered prior to or after the review process shall not relieve the Contractor of this responsibility to comply with the contract documents.

## E. Electronic Submission Requirements:

## 1. Shop Drawings and Product Data:

- a. Submit all equipment and product data for Work of Division 22 together in a group in a single PDF format file, with each item filed behind a cover sheet, and labeled with its respective specification section number, article and paragraph, and mark if applicable.
- b. Include a complete index in the original submittal. Indicate both original items submitted and note stragglers that will be submitted at a later date to avoid delay in submitting.
- c. Additional product data submitted after return of the original file shall include a cover sheet similar to that originally submitted. Upon receipt of the return submittal, insert them in the previously submitted electronic file.
- d. Submission of overall line or general catalog data will not be accepted, submittals must be tailored to specific model being submitted on.

- e. Indication of unit, model, features, etc being submitted must be marked by bold arrow, bold circle or other clear means that will reproduce in black and white. Use of highlights, colored text or other colored indicators cannot be used.
- f. Electronic submissions review and comment will be in electronic PDF format only. Submission in an electronic format will be considered acceptance of this review process and format.
- g. Refer to Division 01 for number of shop drawing copies to be submitted.

1.14 START-UP:

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Owner's Representative seven days prior to start-up of each item.
- C. Verify that each piece of equipment of system has been checked prior to start-up for proper lubrication, drive rotation, belt tension, control sequence, or other conditions, which may cause damage.
- D. Verify that tests, meter readings and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are completed and tested.
- F. Execute start-up under supervision of responsible manufacturer's representative or Contractor's personnel in accordance with manufacturer's instructions.

1.15 FEES, PERMITS AND INSPECTIONS: The Contractor is responsible to apply for and obtain all necessary permits, fees and inspections required by any public authority having jurisdiction. Refer to General Conditions for additional information.

1.16 DEFINITIONS:

- A. "Furnish: Means to supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations.
- B. "Install": Describes operations at project site including actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations.
- C. "Provide": Means to furnish and Install, complete and ready for intended use.

**PART 2 - PRODUCTS****2.1 MATERIAL:**

- A. All materials and products used for construction shall be new, of the best grade, and latest products as listed in printed catalog data. All articles of a kind shall be the standard product of a single manufacturer. Trade names and manufacturers names denote a character and quality of equipment desired and shall no be construed as limiting competition.
- B. Asbestos: Do not use products made of or containing asbestos.

**2.2 QUALITY ASSURANCE:**

- A. Refer to Division 01 Material and Equipment for information regarding available alternatives to materials and equipment specified herein. Product listings are for informational purposes only and establish a general standard of quality.
- B. Provide products which are compatible with other portions of the work and provide products with the proper and correct power and fuel burner characteristics and similar adaptations for the project.

**2.3 INSPECTION:**

- A. All work and materials are subject to field observation at any and all times by the Owner's Representative.
- B. The Contractor shall notify the Owner's Representative a minimum of two days prior to testing any piping system which must be witnessed and accepted before it is covered up or enclosed.
- C. If an observer finds any material or work not conforming to these Specifications, within three days after being notified, remove the materials from the premises and replace with approved materials. If the material has been installed, the entire expense of removing and replacing shall be borne of the Contractor.

**PART 3 - EXECUTION****3.1 EQUIPMENT PROTECTION:**

- A. Keep pipe openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect piping, fixtures, equipment and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore damaged or contaminated fixtures, equipment or apparatus to original conditions or replace at no cost to the Owner.
- B. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.
- C. Cover or otherwise suitably protect equipment and materials stored on the job site.

## 3.2 CLEANING:

- A. General: Clean plumbing equipment, fixtures, piping of stampings and markings (except those required by codes), iron cuttings, and other refuse.
- B. Painted Surfaces: Clean scratched or marred painted surfaces of rust or other foreign mater and paint with matching color industrial enamel, except as otherwise noted.
- C. Before operating any equipment or systems, make thorough check to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated and serviced. Check factory instructions to see that installations have been made accordingly and that recommended lubricants have been used.
- D. Use particular care in lubricating bearings to avoid damage by over-lubrication and blowing out seals. Check equipment for damage that may have occurred during shipment, after delivery or during installation. Repair damaged equipment as approved or replace with new equipment.

## 3.3 LAYOUT AND COORDINATION:

- A. Site Examination: Before starting work, carefully examine site and all contract Drawings so as to become thoroughly familiar with conditions governing work on this project. Verify all indicated elevations, building measurements, roughing-in dimensions and equipment locations before proceeding with any of the work.
- B. The existence of any wires, conduits, pipes, ducts or other service facilities is shown in a general way only. It will be the duty of the Contractor to visit the site and make exact determination of the existence of any such facilities prior to submitting a bid. It is understood that the Contractor will be responsible for making the exact determination of the location and condition of these facilities.
- C. The location of all utilities indicated on the plans is taken from existing public records. The exact location and elevation of all public utilities must be determined by the Contractor. It shall be the duty of the Contractor to ascertain whether any additional facilities other than those shown may be present.
- D. Sleeves, Insets, Cast-in-Place Work: provide sleeves, inserts, anchoring devices, cast-in-place work, etc. which must be set in concrete sequenced at the proper time for the project schedule.
- E. Coordination:
  - 1. Where the work must be sequenced and positioned with precision in order to fit into the available space, prepare accurate scale shop drawings showing the actual physical dimensions required for the installation and submit prior to purchase-fabrication-installation of any of the elements involved in the coordination.
  - 2. Cooperate with other trades in furnishing material and information for sleeves, bucks, chases, mountings, backing, foundations and wiring required for installation of mechanical items.

3. Coordinate all work with other trades and determine in advance where interfacing of the mechanical work and other work are required to be connected together. Provide all materials and equipment to make those connections. Submit shop drawings showing required connections where special conditions exist.
- F. Discrepancies: Report immediately any error, conflict or discrepancy in Plans, Specifications and/or existing conditions. Do not proceed with any questionable items of work until clarification of same has been made. Should rearrangement or re-routing of ducts or piping be necessary, provide for approval the simplest layout possible for that particular portion of the work.
- 3.4 TEMPORARY FACILITIES AND CONTROLS:
- A. Comply with Division 01 requirements.
  - B. Permanent plumbing systems' equipment utilized for temporary facilities shall be started with all controls and safeties installed and operational. Start-up shall be done by a factory approved mechanic only.
  - C. Owner's warranties shall not be abridged by Contractor's use of the permanent systems' equipment prior to final acceptance. Warranty period shall begin at final completion.
- 3.5 MECHANICAL WORK CLOSEOUT:
- A. General: Refer to the Division 01 sections for general closeout requirements. Calibrate all equipment requiring same.
  - B. Record Drawings: Submit record set of drawings required in Division 01, Submittals and as previously specified in this Section.
  - C. Closeout Equipment/Systems Operations: Sequence operations properly so that work of project will not be damaged or endangered. Coordinate with seasonal requirements. Operate each item of equipment and each system in a test run of appropriate duration with the Architect present, and with the Owner's operating personnel present, to demonstrate sustained, satisfactory performance. Adjust and correct operations as required for proper performance. Clean and lubricate each system, and replace dirty strainers, excessively worn parts and similar expendable items of the work.
  - D. Operation and Instruction: Provide eight (8) hours of on-site training to Owner's personnel on all mechanical systems and equipment. Training shall include maintenance, lubrication, troubleshooting and repair. Contractor shall provide necessary written manuals and training aides explaining operational diagrams, emergency and alarm provisions, sequencing requirements, seasonal provisions, security, safety and similar features of the installed system. Three (3) copies of written manuals shall be left with Owner at end of training.

END OF SECTION

## SECTION 22 0300 - PLUMBING

## PART 1 - GENERAL

## 1.1 WORK INCLUDED:

- A. The requirement of this section applies to the plumbing system.

## 1.2 QUALITY ASSURANCE:

- A. Codes: Section 22 0000.
- B. Fixtures: By same manufacturer for each product specified throughout. Color shall be white unless indicated otherwise.
- C. Trim: By same manufacturer for each product specified throughout.

## 1.3 SUBMITTALS:

- A. Submit product data under provisions of Section 22 0000.
- B. Include fixtures, sizes, utility sizes, trim, and finishes.
- C. Submit for:
  - 1. All fixtures.
  - 2. Drains.

## 1.4 PLUMBING FIXTURES:

- A. General: Provide factory fabricated fixtures of type, style and material indicated on the plumbing fixture connection schedule. For each type fixture, provide manufacturer's standard trim, carrier, seats and valves as scheduled or as recommended by manufacturer as required for complete installation.
  - 1. Fixtures: Complete with fittings, supports, fastening devices, faucets, valves, traps, stops and additional devices required.
  - 2. Exposed IPS Piping and Tubing: Brass, chrome plated.
  - 3. Escutcheons: Brass, chrome plated.
  - 4. Fixtures Locations: As shown on Architectural Drawings.
  - 5. Stops: Stops installed on each supply pipe at each fixture accessibly located with wall escutcheons.
  - 6. Showers, Public lavatories, Interior Faucets: Provide with flow control device per code.

## 1.5 OPERATION AND MAINTENANCE DATA:

- A. Submit operation and maintenance data under provisions of Section 22 0000.

## PART 2 - PRODUCTS

## 2.1 INTERIOR PLUMBING MATERIALS:

## A. Cleanouts:

1. Manufacturer: J.R. Smith, Jonespec, Zurn, Wade, or accepted substitute.
2. Types:
  - a. Tile Floor Cleanouts: Smith 4053-U with square heavy-duty nickel bronze top, taper thread, bronze plug, and vandal proof screws.
  - b. Carpeted Floor Cleanout: Smith 4023-U-X with round heavy-duty nickel bronze top, taper thread, bronze plug, carpet clamping device and vandal proof screws.
  - c. Concrete Floor Cleanout: Smith 4023-U with round heavy-duty nickel bronze top, stainless steel shallow cover and vandal proof screws.
  - d. Wall Cleanouts: Smith 4472-U, bronze ferrule with raised head bronze plug, stainless steel shallow cover and vandal proof screws.
  - e. Outside Area Walks and Drives: Smith 4253-U-G with galvanized cast iron body, top secured with vandal proof screws, taper thread and bronze plug. Install in 18" x 18" x 6" deep concrete pad flush with grade.

- B. Flashing: Minimum 4# sheet lead; to extend horizontally 10" from edge of vent penetrations or rain drain body and vertically 12" minimum up from roof turned over and down into hub of vent or finished with bronze cap providing counterflashing for screwed pipe.

- C. Traps: Provide traps on all fixtures except fixtures with integral traps. Exposed traps chromium plated cast brass or 17 gauge chrome plated brass tubing. American Standard, Kohler, Chicago, Brasskraft, Eastman, Speedway, McGuire or approved substitute.

- D. Supplies and Stops: First quality, chrome plated with brass stems. Stops: loose key type. American Standard, Kohler, Chicago, Brasskraft, Eastman, Speedway, McGuire or approved substitute.

- E. Thermometers: 3-inch diameter bi-metal dial thermometer with stainless steel case, white dial, black numbers with 4-inch stainless steel stem and brass separable socket. Provide back or bottom connections as required. 0°F to 200°F range. Weiss, Palmer, Ashcroft, Terrice, Marshalltown, Weksler or approved substitute.

## 2.2 PRIMING VALVES:

- A. Smith 2699, Wade, Zurn, PPP or accepted substitute. Locate in closets, under counters or in walls behind Milcor or access panels as specified in Section 15050. Use copper specified in Section 15060 for all underground priming lines.

**2.3 PLUMBING FIXTURES:**

- A. Stops: Furnish stop valves for all fixtures. Screwdriver style, in wall, angle or straight through pattern to fit installation. Kohler, Speedway, Chicago, Eastman, Brasscraft, or accepted substitute.
- B. Stainless Steel Sink:
  - 1. Type 304, 18 gauge, self-rimming stainless steel sink installed with stainless steel crumb cup strainer outlet, 1-1/2" chrome plated cast brass "P" trap.
  - 2. Manufacturers: Elkay, Just or Brasscraft or accepted substitute.
- C. Drains:
  - 1. Numbers scheduled on drawings represent minimum acceptable standard for locations involved.
  - 2. Install 4 pound sheet lead flashing, extending not less than 10" from and clamped to all drains not completely cast-in-place in a homogeneous material.
  - 3. Manufacturers: Jonespec, Zurn, Jay R. Smith and Wade.

**2.4 YARD HYDRANT:**

- A. Woodford Model Y2 or accepted substitute. Automatic draining, backflow protected, frost proof yard hydrant.

**2.5 EYE WASH:**

- A. Haws Model 8904 or accepted substitute. Provide vacuum breaker Haws SP212, provide emergency tempering valve model 9210EW Axion for tepid water at 10 gpm.

**PART 3 - EXECUTION****3.1 INSPECTION:**

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
- B. Verify adjacent construction is ready to receive rough-in work of this Section.
- C. Review rough-in locations of potable water and waste piping systems to verify actual locations prior to installing fixtures.

**3.2 INSTALLATION:**

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Install components level and plumb.

- C. Install and secure fixtures in place with wall carriers and bolts. Install fixtures as shown on drawings:
  - 1. Support all wall hung water closets and urinals on heavy duty, concealed, chair carriers mounted to floor structure.
  - 2. Support wall hung lavatories mounted on stud partitions on heavy concealed wall brackets bolted to a steel plate anchored firmly to studs with bolts. Plate to extend one stud each way beyond fixture mounting point width. Floor mounted concealed arm carriers approved.
- D. Cleanouts:
  - 1. Where required by code, at each change of sewer direction 45 degrees or greater and more than 10' long, at end of each branch or main and spaced not greater than 100' apart, as required by code and/or as shown on Drawings.
- E. Install all devices in accordance with manufacturer's written instructions and recommendations.
- F. Provide waste piping to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by code.
- G. Mechanical Equipment Connections: Connect piping system to mechanical equipment as indicated. Comply with equipment manufacturer's instructions. Provide shutoff valve and union for each connection. Provide drain valve on drain connection.
- H. Water Hammer Arrestors: Install in upright position, in locations and of sizes per PDI WH-201.
- I. Arrange locations of valves, unions, drains and other components to provide for ease of maintenance, repair or service. Size access panels and locate to provide working spaces for all devices served by access.
- J. Provide valves and shock arrestors where required by code and where otherwise indicated in Specifications and on Drawings.
- K. Fixtures:
  - 1. Install plumbing fixtures where shown and at appropriate heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings and industry standards.
  - 2. Set and connect to soil, waste, vent and water piping in neat, uniform manner. Connections to be plumb and set at right angles to floor and wall unless otherwise required.
  - 3. Seal fixtures mounted on floors and walls with sealant compounds as directed by architect.
  - 4. Install handle of tank type toilets at wide portion of stall.
  - 5. Set mixing valves of lavatories to limit temperature to 110°F.
- L. Stops: Screwdriver or loose key stops to be installed in hot and cold supply pipe to each fixture accessibly located.

## M. Floor Drains:

1. Install drains in accordance with manufacturer's written instructions. See Drawings for locations.
2. Install floor drains at low points of areas to be drained or as indicated. Grate to be flush with finished floor. Set floor sinks as required by local codes.
3. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Prime all drains. Refer to Drawings. Contractor to prime all drain traps at close of construction. Do not utilize trap primers for fill. Coordinate with local authorities for exact requirements.

## 3.3 ADJUSTING AND CLEANING:

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow
- B. At completion clean plumbing fixtures and equipment.
- C. Solidly attach water closets to floor with lag screws. Lead flashing is not intended to hold fixture in place.

## 3.4 INSPECTION:

- A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.
- B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judges by Architect. Remove cracked or dented units and replace with new units.

## 3.5 ELECTRIC WATER HEATERS:

- A. Install in accordance with manufacturer's installation instructions. See Drawings for detail.
- B. Connect hot and cold water piping to units with shutoff valves and unions. Connect recirculating water line to unit with shutoff valve, check valve and union. Pipe relief valve
- C. Anchor tanks to structure.

END OF SECTION

## SECTION 22 0500 - BASIC MATERIALS AND METHODS

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES:

- A. Items common to more than one section of Division 22 and general construction procedures and products. Work described in this Section applies to all Sections of Division 22.

## 1.2 STORAGE AND HANDLING:

- A. Deliver materials to the project site with manufacturer's labels intact and legible. Handle materials with care to avoid damage. Store materials inside protected from weather, dirt and construction dust. Where necessary to store outside, elevate well above grade and enclose with durable, waterproof wrapping. Label equipment as soon as it arrives at job site.

## 1.3 SUBMITTALS:

- A. Submit product data under provisions of Section 15010 and Division 1.
- B. Provide submittals for:
  - 1. Pipe sleeves
  - 2. Escutcheons.
  - 3. Piping and Equipment Identification.

## PART 2 - PRODUCTS

## 2.1 QUALITY ASSURANCE:

- A. Refer to Division 1 Material and Equipment for information regarding available alternatives to materials and equipment specified herein. Product listings are for informational purposes only and establish a general standard of quality.
- B. Provide products which are compatible with other portions of the work and provide products with the proper and correct power and fuel burner characteristics and similar adaptations for the project.

## 2.2 MATERIALS:

- A. All materials and products used for construction shall be new, of the best grade, and the latest products as listed in printed catalog data.
- B. All articles of a kind shall be the standard product of a single manufacturer.

- C. Provide products which are compatible with other portions of the work and products which have the proper electrical power and fuel-burning characteristics for this project.
- D. Trade names and manufacturers names denote the character and quality of equipment desired and shall not be construed as limiting competition.

### 2.3 ACCESS PANELS:

- A. Access panels shall have same fire rating as surface where mounted.
- B. Provide flush key cylinder locks on all access panels less than 8 feet above the floor in public spaces. Turn keys over to Owner at project completion. Screwdriver latches on all others.
- C. Steel, 24" x 24" or as required. Complete with steel frame, hinged locating door, and prime coat finish. Type to match building construction.
- D. Manufacturers: INRYCO/MILCOR Style DW, K or M panels as required by construction. Bilco, Potter-Roemer or accepted substitute.

### 2.4 PIPE SLEEVES:

- A. Interior Wall Sleeves: 12 gage galvanized steel, flush with wall on both sides.
- B. Interior Floor Sleeves: 12 gage galvanized steel and extend 2-inches above finished floor.
- C. Exterior Wall Sleeves: Cast iron, flush with wall on both sides.
- D. On Grade Floor Sleeves: Same as exterior wall sleeves.

### 2.5 ESCUTCHEONS:

- A. Brass material, chrome plated finish. Size sufficient to cover all pipe openings through wall, floor or ceiling. Set screw or spring to secure to pipe.

### 2.6 UNIONS:

- A. Steel pipe union shall be 150-pound malleable iron, brass to iron seat, ground joint, black or galvanized to match pipe.
- B. Copper pipe union shall be 200 psig working pressure. Bronze body. Solder ends.
- C. Insulating unions shall be 250 psig working pressure. Pipe ends and material to match piping. Electric current below 1% of galvanic current. Gasket material as recommended by manufacturer. Epco or approved.

## 2.7 ROOF FLASHING:

- A. Use flashing products specifically designed for and compatible with metal roofing system used.

## 2.8 MISCELLANEOUS STEEL:

- A. Provide steel as required for adequate support of all mechanical equipment, angle or channel, I or H sections as required by application. Provide suitable base plates for stands and anchors for hanging equipment. Drill support holes only in flanges of structural center of length as possible. Apply on coat of black rust inhibitive enamel primer to shop fabricated items before delivery to job; other painting as specified herein. Provide shop drawings of supports especially constructed for this project. Burning of holes is not permitted.

## 2.9 PAINTING:

- A. Apply one coat of black rustoleum primer to shop fabricated items before delivery to job. Other painting as specified herein.

## 2.10 IDENTIFICATION MARKERS:

## A. Pipe Markers:

1. Adhesive pipe markers of width, letter size and background color conforming to ANSI A13.1.
2. Acceptable Manufacturers: Brady B350 with banding tape. Seaton, Zeston, Porter or accepted substitute.

## B. Nameplates:

1. Engraved nameplates, 1/16 inches thick, laminated 3-ply plastic, center ply white, outer ply black, letters formed by exposing center ply.
2. Size: 3 inches by 5 inches nameplates with 1/4-inch high letters.
3. Manufacturers: Lamicoid. Seaton, Brady, Zeston or accepted substitute.

## C. Valve Tags:

1. 1-1/2 inches diameter, 18-gauge polished brass tags with 3/16-inch chain hole and 1/4 inch high stamped, black-filled service designation.
2. Manufacturers: Seaton Style 250-BL, Brady, Zeston or accepted substitute.

## D. Lettering and Graphics:

1. Coordinate names, abbreviations and other designations used in mechanical identification work with designations shown or scheduled. Provide numbers, lettering and wording as indicated for identification of mechanical systems and equipment.
2. Multiple Systems: Where multiple systems of same name are shown provide identification which indicates individual equipment number as well as service (examples: Chiller (CH) No. 1, Chiller (CH) No. 2, Air Conditioning Unit No. 1 (AC) No. 1, Air Conditioning Unit (AC) No. 2.)

## 2.11 CONCRETE FOR MECHANICAL WORK:

- A. Provide strength classes per Building Code.

## PART 3 - EXECUTION

## 3.1 ACCESS PANELS:

- A. Furnish and install access panels required for mechanical work. Access panels shall have same fire ratings as surface where mounted. Furnish panels of adequate size for valves and equipment requiring service and installed above ceilings, behind walls or in furring, complete with correct frame for type of building construction involved. Exact size, number and location of access panels are not necessarily shown. Use no panel smaller than 12 inches by 12 inches for simple manual access or smaller than 16 inches by 20 inches where personnel must pass through. Paint with color and finish to match surrounding architectural features, where exposed.

## 3.2 PIPE SLEEVES:

- A. Sleeves: Large enough in diameter to provide ¼-inch clearance around pipes or insulation. Caulk with watertight rated, UL listed foam-in-place barrier.
- B. Layout: Lay out work in advance of pouring of slabs or construction of wall and furnish and set inserts and sleeves necessary to complete the work.
- C. Coordination: Cutting or patching required as a result of lack of coordination of this operation shall be at no change in contract amount.

## 3.3 FLOOR, WALL AND CEILING ESCUTCHEONS:

- A. Install on piping passing through finished walls, floors, ceilings, partitions and plaster furrings. Escutcheons shall completely cover opening around pipe.
- B. Secure wall and ceiling escutcheons to pipe or structure.
- C. Escutcheons shall not penetrate insulation vapor barriers.
- D. Escutcheons not required in mechanical rooms or unfinished spaces.

## 3.4 PLUMBING EQUIPMENT WIRING:

- A. Provide all plumbing equipment motors, float and similar control devices required, with wiring complete from power source indicated on Electrical Drawings.
- B. Provide properly rated motor overload and under voltage protection and all manual or automatic motor operating devices for all plumbing equipment.

- C. Equipment and systems shown on the Drawings and/or specified, are based upon requirements of specific manufacturers which are intended as somewhat typical of several makes which may be approved. Provide all field wiring and/or devices necessary for a complete and operable system including controls for the actual selected equipment/system.
- D. Provide all starters for mechanical motors. Review Electrical Specifications and Drawings to determine which mechanical motor starters will be provided under the Electrical Specification Sections and provide all others.

### 3.5 PAINTING:

- A. General: Coordinate painting of mechanical equipment and items with products and methods specified under Section 09900, Painting.
- B. Painting Materials: material shall comply with Section 09900, Painting.
- C. Uninsulated Piping: Paint black or galvanized uninsulated piping located buried in ground, in concrete or masonry one (1) coat acid-resisting black paint. Paint black or galvanized uninsulated piping in moist equipment rooms, crawl spaces without vapor barriers or exposed to weather one (1) coat black asphaltum varnish.
- D. Iron Work: Paint hangers, rods, anchors, guides, threads of galvanized pipe, bases, supports, uncoated sheet metal and other iron work without factory finish, exposed to weather, located in moist concealed spaces and moist equipment rooms one coat acid-resisting black paint. Apply one (1) coat Dixon's Aluminum Graphite No. 209 paint over the (1) coat primer as recommended by paint manufacturer to all hot metal surfaces.
- E. Insulated Piping and Other Insulated Surfaces: Paint insulated piping in half-round, split tile, or other inaccessible locations, one (1) coat asphalt emulsion.

### 3.6 PLUMBING SYSTEM IDENTIFICATION:

- A. Piping System: Indicate each pipe system by its generic name (abbreviated) as shown; except vent and drainage piping. Comply with ANSI A13.1 for marker locations, letter sizes, and colors. Include arrows to show direction of flow and "Electric Traced" signs to identify heat cable wrapped piping.
- B. Valve Identification: Tag all valves with brass disc and chain. Prepare valve charts indicating valve number, size, location, function and normal position. Use no duplicate numbers in Plumbing and Heating systems. Mount glazed frames containing one set of valve charts in the building as directed.
- C. Each new piece of equipment shall bear a permanently attached identification plate, listing the manufacturer's name, capacities, sizes and characteristics. In addition to the manufacturer's identification plate, provide nameplates of black phenolic resin laminate and identify new equipment by name and number ½" high letters.

## 3.7 ACCESSIBILITY:

- A. Locate valves, thermometers, cleanout fittings and other indicating equipment or specialties requiring frequent reading, adjustments, inspection, repairs and removal or replacement conveniently and accessibly with reference to the finished building.
- B. Thermometers and Gages: Install thermometers and gages so as to be easily read from the floors, platforms and walkways.

## 3.8 INSTALLATION:

- A. Locating and Positioning Equipment: Comply with all Codes, Regulations and observe good common practice in locating and installing mechanical equipment and material so that completed installation presents the least possible hazard. Maintain adequate clearances for repair, service and operation to all equipment and comply with Code requirements. Set all equipment level or as recommended by manufacturer.
- B. Arrangement: Arrange piping parallel with primary lines of the building construction, and with a minimum of 7' overhead clearance in all areas where possible. Conceal all piping and ductwork. Locate operating and control equipment properly to provide easy access. Give right-of-way to piping which must slope for drainage. Set all equipment level as recommended by manufacturer. Under no conditions shall beams, girders, footings or columns be cut for mechanical items. Casting of pipes into concrete is prohibited unless so shown on Drawings.
- C. Anchorage: Anchor and/or brace all mechanical equipment, piping and ductwork to resist displacement due to seismic action, include snubbers on equipment mounted on spring isolators.
- D. Drip Pans: Provide drip pans under all domestic hot water heaters and all above ceiling in-line pumps. Locate pan immediately below piping and equipment and extend a minimum of 6 inches on each side and lengthwise 18 inches beyond equipment being protected. Fabricate pans 2 inches deep, or reinforced sheet metal (20 gauge copper, or 16 gauge steel with 2 ounces zinc finish hot dipped after fabrication) with rolled edges and soldered or welded seams. Provide 3/4 inch copper drainage piping, properly discharged to over floor drain or as shown on the Drawings. Comply with Mechanical Code for overflow protection and pipe sizing.
- E. Adjusting: Adjust and calibrate all automatic mechanical equipment, mixing valves, flush valves, float devices, etc. Adjust flow rates at each piece of equipment or fixture.
- F. Building Vapor Barrier: Wherever the building insulation vapor barrier is penetrated by mechanical piping, hangers, conduits, ductwork, etc., provide clear self-adhesive tape recommended by the insulation manufacturer around the penetrations.

## 3.9 SYSTEM ADJUSTMENT:

- A. Adjust and calibrate all automatic plumbing equipment, mixing valves, flush valves, float devices, etc. Adjust flow rates at each piece of equipment or fixture. Open and close all shutoff and control valves several times to insure tight glands.

3.10 CUTTING AND PATCHING:

- A. General: Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of plumbing work. Do all necessary cutting and patching of existing yard surfaces required for completion of the plumbing work. Patch to match finish and color of adjacent surfaces.

END OF SECTION

## SECTION 22 0510 - PIPE AND PIPE FITTINGS

## PART 1 - GENERAL

## 1.1 WORK INCLUDED:

- A. Provide all pipe, piping fittings and all related components required for complete piping system. Refer to each specification section for each system for pipe application.

## 1.2 REFERENCES:

- A. ANSI/ASME Sec. 9 – Welding and Brazing Qualifications.
- B. ANSI/ASTM B32 – Solder Metal.
- C. ANSI/AWS D1.1 – Structural Welding Code.
- D. ASME – Boiler and Pressure Vessel Code.
- E. ASTM A53 – Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- F. ASTM A120 – Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.
- G. ASTM A536 – Ductile Iron Castings.
- H. ASTM F477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- I. AWS A5.8 – Brazing Filler Metal.
- J. AWWA C601 – Standard Methods for the Examination of Water and Wastewater.

## 1.3 QUALITY ASSURANCE:

- A. Conform to ANSI/ASME B31.9 for pressurized system as well as all applicable codes.
- B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.
- C. Welders Certification: In accordance with ANSI/ASME Sec 9. and ANSI/AWS D1.1.

## 1.4 SUBMITTALS:

- A. Submit product data under provisions of Section 22 0000 and Division 1.
- B. Include data on pipe materials, pipe fittings and accessories.

## 1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver products to site under provisions of Section 22 0000.
- B. Store and protect products under provisions of Section 22 0000 and provide factory applied end caps each length of pipe and tubes to prevent damage to pipe-ends and eliminate dirt and moisture from inside of pipes and tubes.

## PART 2 - PRODUCTS

## 2.1 SANITARY SEWER AND VENT PIPING, WITHIN 5 FEET OF BUILDING:

- A. Cast Iron Pipe: ASTM A74, hubless, service weight. Fittings: Cast iron. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies. Husky SD4000 or accepted substitute. Pipe and fittings to be marked with the collective trademark of the Cast Iron Soil Institute and be listed by NSF International or must require prior approval of the Engineer.
- B. ABS drainage piping underground: ABS DWV drainage pipe and fittings with solvent cemented joints. Schedule 40 to comply with ASTM D2661 or ASTM F628. Exception: All waste piping from fixtures connected to grease interceptor, or trap, waste and vent piping and garbage disposal waste piping not allowed for ABS use.
- C. ABS drainage piping above grade: ABS DWV drainage pipe and fittings with solvent cemented joints. Schedule 40 to comply with ASTM D2661 or ASTM F628. Exception: All waste piping from fixtures connected to grease interceptor, or trap, waste and vent piping and garbage disposal waste piping not allowed for ABS use. All waste and vent piping within fire rated walls, building assemblies and return air plenums not allowed for ABS use.

## 2.2 WATER PIPING, ABOVE GRADE:

- A. Copper Tubing: ASTM B88, Type L, hard drawn. Fittings: ANSI/ASTM B16.22, cast brass, or ANSI/ASME B16.29, wrought copper. Joints (less than 3-inch): ANSI/ASTM 16.22 solder, Grade 95TA. Joints ( greater than 3-inch): brazed.

## 2.3 CROSS-LINKED POLYETHYLENE TUBING AND FITTINGS:

- A. Tubing:
  - 1. Cross-linked polyethylene (PEX) tubing to comply with ASTM F876 and F877.
  - 2. Tubing shall have a standard grade hydrostatic design stress of not less than 160 PSI for water at 73.4°F, 100 PSI for water at 180°F and 80 PSI for water at 200°F determined in accordance with Plastic Pipe Institute Technical Report.
  - 3. The tubing shall be cross-linked using the “Engel Method.
  - 4. Use of WIRSBO/PEX requires connection details to be included in the Construction Documents. Details shall be provided showing transitions, manifolds, hangers, supports, connections, and attachments.
- B. Fittings:

1. Fittings for tubing shall be brass insert type with reinforcement rings.
  2. Reinforcement rings shall be manufactured to produce a pressure tight seal.
  3. Fitting insert shall be of such dimension in that the tubing must be expanded in order to facilitate insertion of the fitting into the tube.
  4. Expansion of the tubing and ring shall be accomplished by a tool designed expressly for that purpose.
  5. Fittings shall comply with ASTM F877.
- C. Manifolds: Provide premanufactured manifolds of the same manufacturer as the piping.
- D. Manufacturers: Wirsbo or accepted substitute.
- 2.4 COMPRESSED AIR PIPING:
- A. Steel Pipe. ASTM A53 or A120, Schedule 40 black. Fittings: ANSI/ASME B16.3, malleable iron, or ASTM A234, forged steel welding type. Joints: Screwed for pipe two inches and under; ANSI/AWS D1.1, welded, for pipe over two inches.
- 2.5 PRIMING LINES:
- A. Copper Tubing: ASTM B88, Type L annealed. Fittings: ANSI/ASTM B16.22, wrought copper. Joints: ANSI/ASTM B16.22, solder, Grade 95TA.
- 2.6 MISCELLANEOUS PIPING MATERIAL:
- A. Welding Materials: Provide welding materials as determined by the installer to comply with installation requirements. Comply with Section 2-C, ASME Boiler Code for welding materials.
- B. Soldering and Brazing Materials: Provide soldering materials as determined by the installer to comply with installation requirements.
1. Tin-Antimony Solder: ASTM B32, Grade 95TA.
  2. Lead-Free Solder: ASTM B32, Grade HB. Harris "Bridgit" approved.
  3. Silver Solder: ASTM B32, Grade 96.5TS.
- C. Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast-iron flanges; raised-face for steel flanges. Pressure and temperature rating required for the service indicated.
- D. Sleeve Seal: Rubber-link pipe wall and casing closure. Thunderline Link-Seal. For fire rated wall, floor or ceiling penetrations, 3-M "CP-25" caulk, "No. 303" putty and/or "PSS 7904" sealing system.
- E. Tracer Wire: 14 gauge, single strand, copper wire with blue insulation for water, green for sanitary and storm sewers, and orange for gas. 3M "DBY" direct bury splice kit required at all splices.
- 2.7 FLANGES, UNIONS, AND COUPLINGS:

- A. Pipe Size 2 Inches and Under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.
- B. Pipe Size Over 2 Inches: 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping; neoprene gaskets for gas service; 1/16 inch thick performed neoprene bonded to asbestos.
- C. Grooved and Shouldered Pipe End Couplings: Malleable iron housing clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; "C" shape composition sealing gasket; steel bolts, nuts, and washers; galvanized couplings for galvanized pipe.
- D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier. Victaulic "Clear Flow", Epcoc or accepted substitute.

## 2.8 PIPE SLEEVES:

- A. Minimum 20 gauge galvanized steel in concrete, 18 gauge in all other construction. Provide ½-inch clearance around pipe or insulation. Provide UL approved fire-rated assemblies/caulking. 3M or accepted substitute.

## 2.9 ESCUTCHEONS:

- A. Brass material, chrome plated finish. Size to cover all pipe openings through wall, floor or ceiling. Set screw or spring to secure pipe. Coordinate all opening sizes.

## PART 3 - EXECUTION

### 3.1 PREPARATION:

- A. Ream pipe and tube ends. Remove burrs or bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

### 3.2 INSTALLATION:

- A. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Route piping in orderly manner, maintain gradient and conceal all piping unless otherwise indicated.
- C. Install piping to conserve building space, not to interfere with use of space or access panels and parallel with walls.
- D. Group piping whenever practical at common elevations.

- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Provide loops, swing joints, pinchers, runouts and spring pieces to prevent damage to piping or equipment.
- F. Provide clearance for installation of insulation and access to valves and fittings.
- G. Where piping is installed in the exterior building envelope or in any component of the exterior building envelope it shall be located on the warm building interior side of the building envelope insulation.
- H. Slope water piping and arrange to drain at low points and provide drain valve.
- I. Establish elevations of buried water piping outside the building to ensure not less than 3 feet of cover.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- K. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting. Refer to Section 22 0500.
- L. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients.
- M. Pitch vent piping at 1/4 inch per 10 feet minimum.
- N. Establish elevations of all heating and cooling piping to ensure minimum of 1 inch pitch for every 40 feet to low point drip or drains.
- O. Unions and Flanges: At all equipment to permit dismantling and elsewhere as consistent with good installation practice.
- P. Tracer Wire: Provide tracer wire as close to underground non-metallic water, sanitary and storm sewers and gas pipe in the trench as possible. Tracer wire shall be accessible at grade via all services, valve and meter boxes, curb cocks, cleanouts at the building, manholes (inside the cover near the top), etc. Locate all points on the record as-installed drawings. Splice into utility tracer system where available. Comply with code requirements.
- Q. Cross-Linked Polyethylene Tubing and Fittings:
  - 1. Tubing Under Concrete Slab: Install tubing in excavated ditch below Concrete slab. Backfill tubing with sand. When making 90-degree bends exiting the slab, use metallic 90-degree elbows (one size larger than nominal tubing.)
  - 2. Tubing Through Wall or Overhead: Tubing slack of 1.8 to 3/16-inch per lineal foot shall be allowed to accommodate thermal expansion. Do not pull tubing tight during installation. Do not rigidly anchor tubing. Protect tubing passing through hollow masonry walls or metal studs with sleeves or grommets (Semco Trisolators or accepted substitute). Protect tubing from nail or screw damage with steel plate protectors.
  - 3. Tubing Supports: Use plastic pipe supports or supports designed for use with plastic tubing. Provide vertical support at every floor with a guide placed between floors.

4. Joints and Connections: Make fittings and connections in compliance with manufacturer's recommendations. Make transition joints with manufacturer approved fittings only.
  5. Fire Rated Wall, Floor or Ceiling Penetrations: Firestopping shall conform to both Flame and Temperature ratings as required by local building codes and ASTM E814. Use firestop material compatible with tubing.
  6. Inspection and Testing: After completion of any section of the installation, test and inspect so there are no visible signs of leakage, cracks, gouges or excess debris.
- R. Corrosion Control Underground Steel Piping Corrosion Protection: Factory wrap all uninsulated underground steel piping systems with protective coating composed of a coal-tar saturated wrapping tape over a 20 mil thick coal-tar epoxy coating. Wrap joints with a minimum of ½ width of wrap. Extend wrap not less than 4-inches above grade.
- S. Pipe Sleeves: Lay out work in advance of pouring concrete and furnish and set sleeves necessary to complete work.
1. Floor Sleeves: Provide sleeves on pipes passing through concrete construction. Extend sleeve 2-inches above finished floor. Caulk all pipes passing through floor with nonshrinking grout or approved caulking compound. Provide Link-Seal sleeve sealing system for slab on grade. Caulk/seal all piping passing through fire rated building assemblies with UL rated assemblies. Provide fire-rated assemblies per local code requirements.
  2. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk all pipes passing through walls with nonshrinking caulking compound. Caulk/seal all piping passing through fire rated building assemblies with UL rated assemblies. Provide fire-rated assemblies per local code requirements.
- T. Expansion and Flexibility: Install all work with due regard for expansion and contraction to prevent damage to piping, ductwork, equipment, building and its contents. Provide piping offsets, loops, approved type expansion joints, anchors or other means to control piping movement and to minimize pipe forces.
- U. Escutcheons: Install on all exposed pipes passing through wall or floors and on fixture stops and waste connections to wall.
- V. Flexible Above Grade Gas Piping: Install per manufacturers recommendations.
- 3.3 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM:
- A. Prior to starting work, verify system is complete, flushed and clean.
  - B. Comply with all applicable code requirements including procedure outlined by Health Department.
- 3.4 CLEANING:

- A. General: Clean all dirt and construction dust and debris from all mechanical piping systems and leave in a new condition. Touch up paint where necessary.
  - B. Sanitary and Storm Drainage System:
    - 1. Remove construction debris from cleanouts, drains, strainers, baskets, traps, etc., and leave same accessible and operable. Place plugs in the end of uncompleted piping at the end of the day or whenever work tops.
    - 2. Before final acceptance of completed sewer system, flush and clean the entire system with water. Trap and remove solid material obtained from flushing and cleaning from the new system. Do not allow debris to enter the sewer system.
  - C. Gas Piping: Blow clear of debris with nitrogen or oil free air. Clean all low point strainers and pockets.
- 3.5 TEST:
- A. General:
    - 1. Minimum duration of two hours or longer, as directed for all tests. Furnish report of test observation signed by qualified inspector. Make all tests before applying insulation, backfilling, or otherwise concealing piping or connecting fixtures or equipment. Where part of the system must be tested to avoid concealment before the entire system is complete, test that portion separately, same as for entire system.
  - B. Sewer: Furnish all facilities and personnel for conducting the test. Test in accord with the requirements of State Plumbing Inspector and local authorities.
  - C. Plumbing Waste and Vent Piping: Hydrostatic test by filling to highest point, but not less than 10 foot water column on major horizontal portion.
  - D. Water Piping: Hydrostatic pressure of 100 psig without loss for four hours.

END OF SECTION

## SECTION 22 0523 - VALVES

## PART 1 - GENERAL

## 1.1 WORK INCLUDED:

- A. The requirements of this Section apply to the valving for the systems specified elsewhere in Division 22.

## 1.2 QUALITY ASSURANCE:

- A. Provide valves from a single manufacturer where possible with manufacturer's name and pressure rating marked on valve body.
- B. All castings used for valve bodies shall be date stamped for quality assurance and traceability.
- C. Valve size shall be the same as connecting pipe size unless otherwise noted.
- D. Grooved end valves shall be of the same manufacturer as the adjoining couplings.

## 1.3 SUBMITTALS:

- A. Submit product data under provisions of Section 15010.
- B. Include data on valves and accessories.

## PART 2 - PRODUCTS

## 2.1 BALL, CHECK, STOP CHECK, NON SLAM CHECK, BUTTERFLY, GATE, GLOBE, LUBRICATED PLUG VALVE TYPES:

- A. Manufacturers: Crane, ITT, Grinnell, Hammond, Jenkins, Kennedy, Mueller, Lunkenheimer, Milwaukee, Nibco, Apollo, Powell, Stockham, Walworth, Legend or accepted substitute. Grooved end valves Victaulic, Gustin-Bacon or accepted substitute. Victaulic (grooved end) and Grinnell (screwed/flanged) numbers are given except as noted.
- B. Domestic Water:
  - 1. Valves 2 inches and smaller:
    - a. Ball:
      - 1) Victaulic Series 589 (brass body) and 569 (stainless steel body).
      - 2) Fig. 3500. 125 psi, bronze body, full port.

- b. Check, Fig. 3300. Class 125, bronze body, horizontal swing.
  - c. Gate, Fig. 3050. 150 psi, bronze body, non-rising stem.
2. Valves 2 inches and larger:
- a. Butterfly:
    - 1) (<250 deg. F), Victaulic MasterSeal; Stem shall be offset from the disc centerline to provide full 360-degree circumferential seating, pressure responsive seat, 300 psi, ductile iron body.
    - 2) (<230 deg. F), Victaulic Series 608; copper-tube dimensioned grooved ends, 300 psi, cast bronze body.
    - 3) (<200 deg. F), Fig. 8000. 150 psi cast iron body.
  - b. Check:
    - 1) Victaulic Series 716, 300 psi, ductile iron body, horizontal or vertical, with stainless steel spring.
    - 2) Fig. 6300 A. Class 125 cast iron body, horizontal swing.
    - 3) Double Check Backflow, Febco only.
  - c. Gate, Fig. 6020 A. Class 125, cast iron body, non-rising stem.
  - d. Globe, Fig. 6200 A. Class 125, cast iron body, renewable seat, bronze mounted.

## 2.2 WATER PRESSURE REDUCING VALVES:

- A. Up to 2 inches : Bronze body, stainless steel and thermoplastic internal parts, threaded ends.
- B. Over 2 inches: Cast iron body , bronze fitted, elastomer diaphragm and seat disc, flanged ends.
- C. Provide each pressure reducing valve with strainer on inlet or internal strainer.
- D. Manufacturers: Cash-Acme, Fisher, Foster, Leslie, McAlear, Spence, Watts or accepted substitute.

## 2.3 RELIEF VALVES:

- A. Bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.
- B. Manufacturers: Cash-Acme, Fisher, Foster, Spence, Watts or accepted substitute.

## 2.4 PRIMING VALVES:

- A. Locate in closets, under counters or in walls behind Milcor or access panels as specified in Section 22 0000. Use copper specified in Section 15060, Pipe and Pipe Fittings, for all underground priming lines.
- B. Manufacturers: PPP, Wade, Zurn, Smith or accepted substitute.

**2.5 DISHWASHER AND COOKING EQUIPMENT WATER PRESSURE REDUCING VALVE:**

- A. All brass, single seat type for dead end service, with a renewable stainless steel seat and valve. Code approved for potable water usage. Provide shut-off valves, pressure relief valve unions, drain and bypass. Designed for service on hot water to reduce pressure per manufacturer's specification.
- B. Manufacturers: Leslie, Watts, Fisher, Spencer, Cash-Acme, McAlear, or accepted substitute.

**PART 3 - EXECUTION****3.1 INSTALLATION:**

- A. Provide clearance for installation of insulation and access to valves and fittings.
- B. Provide access where valves and fittings are not exposed. Coordinate size and location of access door with Section 22 0000.
- C. Install valves with stems upright or horizontal, not inverted.
- D. Provide one plug cock wrench for every five plug cocks sized 2 inches and smaller. Provide each plug cock sized 2-1/2 inches and larger with a wrench with set screw.
- E. Lubricant-Seal: Select and install plug valves with lubricant-seal except where frequent usage is indicated or can be reasonably expected to occur.
- F. Grooved joint valves shall be installed in accordance with the manufacturer's latest published installation instructions. The seat material shall be suitable for the intended service. The coupling manufacturer's factory-trained representative shall provide on-site training for the contractor's field personnel in the proper use of grooving tools and installation of grooved joint products. The representative shall periodically visit the job site to ensure best practices in grooved joint installations are being followed. (A distributor's representative is not considered qualified to conduct the training.)
- G. Fluid Control: Install gate, ball, globe, plug, and butterfly valves to comply with ANSI B31. Install check valves where indicated and where flow reversal is obviously not desirable and can be reasonably expected to occur, including piping at the discharge of pumps. Install silent check valves where necessary to eliminate water hammer occurring from reversal of flow.
- H. Application: Valve type and style as shown on the Drawings. Where style is not indicated, use the following:
  - 1. Domestic Water: Ball valves for 2 inches and smaller and butterfly for 2 inches and over.
  - 2. Use non-rising stem gate valves.

**END OF SECTION**

## SECTION 22 0529 - SUPPORTS AND ANCHORS

## PART 1 - GENERAL

## 1.1 WORK INCLUDED:

- A. Provide pipe and equipment hanger, support, anchors and all related items for complete systems.

## 1.2 QUALITY ASSURANCE:

- A. Provide pre-manufactured horizontal piping and ductwork hangers, clamps, hanger rod, shields, supports, etc.
- B. Seismic requirements: Provide seismic restraints in accord with the latest edition of "Seismic Restraint Manual Guidelines" as published by SMACNA. Seismic Hazard Level (SHL) of "A". A lower SHL will be allowed provided the contractor provides calculations stamped by a registered professional structural engineering in the state the project is located indicating a lower SHL is acceptable.

## 1.3 SUBMITTALS:

- A. Submit product data under provisions of Section 22 0000.
- B. Submit construction details, and performance characteristics for each type and size of anchor, hanger and support.

## PART 2 - PRODUCTS

## 2.1 HANGERS AND SUPPORTS:

- A. Listed Types: The Manufacturers Standardization Society (MSS) Piping Types listed with Grinnell figure numbers in parentheses where applicable (or another manufacturer's as noted). ITT Grinnell, Elcen, Michigan, Super Strut, Kindorf, Unistrut or accepted substitute.
- B. Horizontal Piping Hangers and Supports:
  - 1. Adjustable Clevis Hanger: MSS Type 1 (Fig. 260).
  - 2. Adjustable Band Hanger: MSS Type 7 (Fig. 97), fabricated from steel.
  - 3. Adjustable Swivel-Band Hanger: MSS Type 10 (Fig.70).
  - 4. Clamp: MSS Type 4 (Fig. 212, 216).
  - 5. Double-Bolt Clamp: MSS Type 3 (Fig. 295A, 295H), including pipe spacers.
  - 6. Pipe Anchors: (Carpenter & Peterson Fig. 145CI) Steel weld type to pipe for sizes up to 20 inches in diameter.

7. Adjustable Saddle-Support: MSS Type 36 (Fig. 258) and MSS Type 37 (Fig. 259), including saddle, pipe and reducer. Fabricate base-support from steel pipe and include cast-iron flange or welded-steel plate.
- C. Equipment and Piping Supports:
1. Channel Support System: Galvanized, 12 gauge channel and bracket support systems, single or double channel as indicated on the Drawings or as required by piping and equipment weights. Grinnell "Power "Strut" channel.
  2. Steel Brackets: Welded structural steel shapes complying with one of the following:
    - a. Light Duty: MSS Type 31 (Fig. 194).
    - b. Medium Duty: MSS Type 32 (Fig. 195).
    - c. Heavy Duty: MSS Type 33 (Fig. 199).
- D. Vertical Pipe Clamps:
1. Two-Bolt Riser Clamp: MSS Type 8 (Fig. 261).
  2. Four-Bolt Riser Clamp: MSS Type 42 include pipe spacers at inner bolt-holes.
- E. Hanger Rod Attachment:
1. Hanger Rod: Right hand threaded, (Grinnell Fig. 140 or 146 for all sizes).
  2. Turnbuckles: MSS Type 13 (Fig. 230).
  3. Weldless Eye-Nut: MSS Type 17 (Fig. 290).
  4. Malleable Eye-Socket: MSS Type 16 (Fig. 110R).
  5. Clevises: MSS Type 14 (Fig. 299).
- F. Building Attachments:
1. Concrete Inserts: MSS Type 18 (Fig. 282), steel or Grinnell Power-Strut PS349 continuous channel.
  2. Clamps: MSS Type 19 (Fig. 285, 281), Type 20, 21 (Fig. 225, 226, 131), Type 23 (Fig. 86, 87,88), Type 25 (Fig. 227), Type 27 through 30 where applicable.
- 2.2 SADDLES AND SHIELDS:
- A. Listed Types: The Manufacturers Standardization Society (MSS) Piping Types listed with Grinnell figure numbers in parentheses where applicable (or another manufacturer's as noted).
- B. Protection Saddles: MSS Type 39 (Fig. 160).
- C. Protection Shields: MSS Type 40 (Fig. 167).
- D. Preinsulated Pipe Supports: Pipe Shields Inc. or accepted substitute.
1. Pipe supported on rods - Model A1000, through A4000 and A9000.
  2. Pipe supported on flat surfaces - Model A1000, A2000, A5000 through A7000.
  3. Pipe supported on pipe rolls - Model A3000 through A6000 and A8000.

### 2.3 MISCELLANEOUS HANGER MATERIALS:

- A. Metal Framing: Provide products complying with NEMA STD ML 1.
- B. Steel Plates, Shapes and Bars: ASTM A-36.
- C. Cement Grout: Portland Cement (ASTM C-150, 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 only the minimum amount of water required for placement and hydration.
- D. Heavy Duty Steel Trapezes: Fabricate from steel shapes selected for the loads required; weld steel in accordance with AWS Standards.
- E. Pipe Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of a bolted two-section outer cylinder and base with a two-section guiding spider bolted tight to the pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of the length recommended by the manufacturer to allow indicated travel.
- F. Standard Bolts and Nuts: ASTM A 307, Grade A.
- G. Concrete Anchors: Rawl Lok/Bolt, Hilti "HSL," ITT Phillips, Red Head Wedge Anchors, Ramset Trubolt or Dynabolt or accepted substitute.
- H. Shop Primer: Manufacturer's standard rust inhibitive primer.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF HANGERS AND SUPPORTS:

- A. General: Proceed with the installation of hangers, supports and anchors only after the required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) the proper placement of inserts, anchors and other building structural attachments.
  - 1. Install hangers, supports, clamps, and attachments to support piping and equipment properly from the building structure. Use no wire or perforated metal to support piping, and no supports from other piping or equipment. For exposed continuous pipe runs, install hangers and supports of the same type and style as installed for adjacent similar piping.
  - 2. Prevent electrolysis in the support of copper tubing by the use of hangers and supports which are copper plated, or by other recognized industry methods.
  - 3. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at panel points only.

4. Install hangers and supports to provide the indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded. Comply with the following installation requirements:
  - a. Clamps: Attach clamps, including spacers (if any), to piping outside the insulated piping support. Do not exceed pipe stresses allowed by ANSI B31.
  - b. Insulated Pipe Supports: Insulated pipe supports shall be supplied and installed on all insulated pipe and tubing.
  - c. Load Rating: All insulated pipe supports shall be load rated by the manufacturer based upon testing and analysis in conformance with ASME B31.1, MSS SP-58, MSS SP-69 and MSS SP-89.
  - d. Support Type: Manufacturer's recommendations, hanger style and load shall determine support type.
  - e. Insulated Piping Supports: Where insulated piping with continuous vapor barrier or where exposed to view in finished areas is specified, install hard maple wood insulation shields (Elcen Fig. 216) or steel pipe covering protection shields (MSS type 39) at each hanger.

B. Provisions for Movement:

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units.
2. Install hangers and supports so that equipment and piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

C. Pipe Hangers and Supports:

1. Vertical Spacing: Support at base, every floor height not exceeding 10 feet and required by Code and just below roof line.
2. Screwed or Welded Steel or Copper Piping: Maximum hanger spacing shall be as follows:

	Steel	Copper
1-1/4 inches and smaller	6 foot span	5 foot span
1-1/2 inch pipe	9 foot span	6 foot span
2 inch pipe	10 foot span	10 foot span
2-1/2 inch	11 foot span	10 foot span
4 inches and larger	12 foot span	10 foot span

3. Cast Iron Soil Pipe:
  - a. Hubless and Compression Joint: At every other joint except when developed length exceeds 4 feet, then at each joint.
  - b. Additional Support: Provide at each horizontal branch and/or at concentrated loads to maintain alignment and prevent sagging.
4. Install additional hangers or supports at concentrated loads such as pumps, valves, etc. to maintain alignment and prevent sagging.
5. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
6. Place a hanger within 12 inches of each horizontal elbow.

7. Support Rod: Hanger support rods sized as follows:

Pipe Size	Rod Diameter	Max. Load
2 inches and smaller	3/8 inch	610 lb.
2-1/2 to 3 inches	1/2 inch	1130 lb.
4 inches	5/8 inch	1810 lb.
6 inches	3/4 inch	2710 lb.
8 through 12 inches	7/8 inch	3770 lb.

- D. Adjust hangers and supports to bring piping to proper levels and elevations.
- E. Provide all necessary structural attachments such as anchors, beam clamps, hanger flanges and brackets in accordance with MSS SP-69. Attachments to beams wherever possible. Supports suspended from other piping, equipment, metal decking, etc., are not acceptable.
- F. Horizontal banks of piping may be supported on common steel channel member spaced not more than the shortest allowable span required on the individual pipe. Maintain piping at its relative lateral position using clamps or clips. Allow lines subject to thermal expansion to roll axially or slide. Size channel struts for piping weights.

### 3.2 INSTALLATION OF ANCHORS:

- A. Install anchors at the proper locations to prevent stresses from exceeding those permitted by ANSI B31, where recommended in SMACNA "Seismic Restraint Manual" or exceeding manufacturer's recommended loading, and to prevent the transfer of loading and stresses to connected equipment.
- B. Welding: Provide anchor by welding steel shapes, plates and bars to the piping and/or equipment and to the structure. Comply with ANSI B31 and AWS standards and SMACNA "Seismic Restraint Manual."
- C. Bolting: Provide standard plate washers under heads and nuts of bolts bearing on wood. Soap threads of lag bolts prior to installing.
- D. Structural Blocking: Locate as indicated and as required to support mechanical piping and equipment.
- E. Where expansion compensators are indicated, install anchors in accordance with the expansion unit manufacturer's written instructions, to limit movement of piping and forces to the maximums recommended by the manufacturer of each unit.
- F. Anchor Spacings: Install anchors at the ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends. Make provisions for presetting of anchors as required to accommodate both expansion and contraction of piping.
- G. Painting: Refer to Section 22 0000.

END OF SECTION

## SECTION 22 0700 - MECHANICAL INSULATION

## PART 1 - GENERAL

## 1.1 WORK INCLUDED:

- A. Provide piping and equipment insulation including jacketing, adhesive and all related accessories for complete insulated system.

## 1.2 QUALITY ASSURANCE:

- A. Applicator: Company specializing in piping insulation application with three years minimum experience.
- B. Insulation, Jacket and all Related Materials: Flame spread rating of 25 and smoke developed rating of 50.
- C. Codes: Comply with all applicable codes.
- D. Installation: Install in accordance with Manufacturer's recommendations.
- E. Prohibited substances: The following substances are prohibited in the State of Oregon for use in manufacturing duct insulation, wraps, or covers and pipe insulation, wraps or covers. Products containing these substances are not allowed for use.
  - 1. Pentabrominated diphenyl ether CAS#32534-81-9.
  - 2. Octobrominated diphenyl ether CAS#32536-52-0.
  - 3. Decabrominated dphenyl ether CAS#1163-19-5.

## 1.3 SUBMITTALS:

- A. Submit product data and installation instructions under provisions of Section 22 0000.
- B. Include product description, list of materials and thickness for each service, and locations.

## 1.4 DELIVERY, STORAGE AND HANDLING:

- A. Deliver product to site under provisions of Section 22 0000.
- B. Store and protect product under provisions of Section 22 0000.
- C. Store insulation in original shipping container with labeling in place. Do not install damaged insulation.

## 1.5 FIRE HAZARD CLASSIFICATION:

- A. Maximum fire hazard classification of the composite insulation to be not more than a flame spread of 25, fuel contributed of 50 and smoke developed of 50 as tested by ASTM E84, NFPA 255 and UL 723 method.
- B. Test pipe insulation in accordance with the requirements of UL “Pipe and Equipment Coverings R5583 400 8.15.”, ASTM C1136 and ASTM C547.
- C. Test duct insulation in accordance with ASTM E84 and ASTM C1071 and bear the UL label.

## PART 2 - PRODUCTS

## 2.1 ACCEPTABLE MANUFACTURERS:

- A. Insulating Manufacturers: Johns Manville, Knauf, Armstrong, Owens-Corning, Pabco, IMCOA, Certain Teed or accepted substitute.
- B. Adhesive Manufacturers: Benjamin Foster, 3M, Borden, Kingco or Armstrong.

## 2.2 PIPING INSULATION, JACKETING AND ACCESSORIES:

- A. Fiberglass Pipe Insulation:
  - 1. Fiberglass™ Evolution™ Paper-free ASJ Pipe Insulation.
  - 2. Pipe system to minus 10 to 55 deg. F: Flexible, preformed, pre-slit, self-sealing elastomeric, thermal conductivity of 0.27 Btu/hr. sq. ft./in. at 75 deg. F and vapor transmission rating of 0.2 perms/inch. Apply in thickness necessary to prevent condensation on the surface.
  - 3. Piping Systems 55 to 600 deg. F: Glass fiber preformed pipe insulation with a minimum K-value of 0.23 at 75 deg. F, a minimum density of 3.5 pounds per cubic foot.
  - 4. Pipe System Up to 1200 deg. F: High temperature molded calcium silicate insulation with factory applied aluminum metal jacket. Furnish with aluminum snap straps.
- B. Elastomeric Foam: ASTM C534; flexible, cellular elastomeric. Thermal Conductivity value: 0.27 at 75°F. Maximum Flame Spread: 25. Maximum Smoke Developed: 50 (3/4-inch thick and below). Connection: Waterproof vapor retarder adhesive as needed. UV Protection: UV outdoor protective coating as needed.
- C. Plastic Pipe Insulation: Flexible unicellular polyolefin foam insulation complying to ASTM C534, ASTM E84 (25/50), UL 723 (25/50). Thermal conductivity of 0.24 (BTU/in)/(hr/sq.ft./deg. F) at 75°F. Preslit longitudinal seam. Imoca.
- D. Fiberglass Insulation: Flexible Fiber Glass Blanket: ASTM C612; flexible. Thermal Conductivity Value: 0.24 at 75°F. Maximum Service Temperature: 450°F.

- E. Handicapped Lavatory Insulation Kit: ASTM: P-traps, hot water and cold water insulating guards. Molded closed cell vinyl with nylon fasteners, paintable. Thermal conductivity:  $K=1.17$  (BTU/in)/(hr/sq.ft./deg. F) at 75°F means temperature. Provide accessories as required for complete installation. Color white. Truebro Inc. Model 102. McGuire, ProWrap, Brocar Trap Wrap or accepted substitute.
- F. Jackets:
  - 1. Interior Applications:
    - a. Vapor Barrier Jackets: Kraft reinforced foil or vinyl vapor barrier with self-sealing adhesive joints or pressure sensitive seal.
    - b. PVC Jackets: One piece, premolded type. "
  - 2. Exterior Applications:
    - a. Aluminum Jackets: ASTM B209; 0.016 inch thick; smooth finish.
    - b. Stainless Steel Jackets: Type 316 stainless steel; 0.010 inch thick; smooth finish.
- G. Accessories:
  - 1. Insulation Bands: 3/4 inch wide; 16 gauge stainless steel.
  - 2. Metal Jacket Bands: 0.25 thick stainless steel.
  - 3. Insulating Cement: ANSI/ASTM C195; hydraulic setting mineral wool.
  - 4. Finishing Cement: ASTM C449.
  - 5. Fibrous Glass Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.

### 2.3 PIPE FITTING INSULATION COVERS:

- A. PVC preformed molded insulation covers. Zeston or accepted substitute.

## PART 3 - EXECUTION

### 3.1 PREPARATION:

- A. Install materials after piping, ductwork and equipment has been tested and approved.

### 3.2 PIPING INSULATION INSTALLATION:

- A. Install materials in accordance with manufacturer's instructions.
- B. Continue insulation with vapor barrier through penetrations.
- C. In exposed piping, locate insulation and cover seams in least visible locations.

- D. Provide an insert, not less than 6 inches long, of same thickness and contour as adjoining insulation, between support shield and piping, but under the finish jacket, on piping 2 inches diameter or larger, to prevent insulation from sagging at support points. Inserts shall be cork or other heavy density insulating material suitable for the planned temperature range. Factory fabricated inserts may be used.
- E. Neatly finish insulation at supports, protrusions, and interruptions.
- F. Jackets:
1. Indoor Applications: Insulated pipes conveying fluids above ambient temperature shall have standard jackets, with vapor barrier, factory-applied or field applied. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass cloth and adhesive.
  2. Exterior Applications: Provide vapor barrier jackets. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement.
  3. Buried Piping: Insulate with Plastic Pipe Insulation. Same thickness as specified for pipe sizes and applications listed in the schedule below.
- G. Piping Insulation Schedule:

<u>PIPING</u>	<u>PIPE SIZE</u>	<u>INSULATION</u>
Domestic Cold	All	½" fiberglass
Domestic Hot/Tempered and Recirculating	2" and Smaller	1-1/2" fiberglass
	2-1/2" and Larger	1-1/2" fiberglass
Piping Exposed to Freezing Horizontal and vertical	All Sizes	1-1/2" fiberglass
Roof Drain	All Sizes	1" fiberglass
Roof Drain Body	All Sizes	1" fiberglass equipment Insulation

- H. Handicapped Lavatory: Insulation as specified.
- I. Pipe Fittings:
1. Insulate and finish all fittings including valve bodies, bonnets, unions, flanges and expansion joints with precut fiberglass insulation and preformed PVC covers sealed to adjacent insulation jacket for continuous vapor barrier covering over all fittings.
- J. Piping Insulation Lap Seams and Butt Joints: Install insulation jacket in accordance with manufacturer's recommendation. Where jacket joint and lap seams have not adhered, remove affected section of insulation and reinstall.
- K. Heat Tracing: Where electric heat tape is to be installed on piping, insulate over the tape.
- L. Where piping is installed in the exterior building envelope or in any component of the exterior building envelope it shall be located on the warm building interior side of the building envelope insulation.

3.3 INSULATED PIPE EXPOSED TO WEATHER:

- A. Cover insulation with aluminum jacket. Seal watertight jacket per manufacturer's recommendation. Provide heat tracing on piping subject to freezing.

3.4 PLASTIC PIPE INSULATION:

- A. Slip insulation on pipe prior to connection. Butt joints sealed with manufacturer's adhesive. Insulate fitting with miter-cut pieces. Cover all insulation exposed to the weather and under grade with 2 coats of finish as recommended by manufacturer.

3.5 FLEXIBLE ELASTOMERIC TUBING:

- A. Slip insulation over piping or if piping is already installed, it should be slit and snapped over the piping. All joints and butt ends must be adhered with adhesive.

3.6 INSULATION SHIELDS:

- A. Provide full size diameter hangers and shields (18 gauge minimum) for all cold piping. Hot water piping hangers may penetrate insulation to contact piping directly.

END OF SECTION

DIVISION 23 SPECIFICATION

SECTION 23 0000	GENERAL PROVISIONS
SECTION 23 0500	BASIC MATERIALS AND METHODS
SECTION 23 0529	SUPPORTS AND ANCHORS
SECTION 23 0594	TESTING, ADJUSTING, AND BALANCING
SECTION 23 0700	MECHANICAL INSULATION
SECTION 23 3300	AIR DISTRIBUTION
SECTION 23 3450	DUST COLLECTOR

## SECTION 23 0000 - GENERAL PROVISIONS

## PART 1 - GENERAL

- 1.1 GENERAL REQUIREMENTS: Drawings and general provisions of the Contract, including General and other conditions and Division 1 - General requirements Sections apply for the work specified in this Section.
- 1.2 SCOPE OF WORK: The work covered by this Specification shall include furnishing all labor, materials, equipment and services to construct and install the complete mechanical system as shown on the Drawings and specified herein. Verify all conditions on the job site and lay out work accordingly.
- 1.3 RELATED WORK:
- A. The General Provisions apply to this Division, including but not limited to:
1. Drawings and Specifications.
  2. Contract Modifications, addendums and change orders.
- B. Division 1, General Requirements, applies to this Division, including but not limited to:
1. Summary of Work.
  2. Coordination. In addition, it shall be the responsibility of each trade performing work specified under Division 23 to coordinate with all others for proper and adequate installation clearance.
  3. Cutting and Patching. The cost of cutting and patching required work of Division 23 and not shown in other Divisions of Work shall be included in the cost of Division 23.
  4. Shop Drawings, Product Data and Samples.
  5. Temporary Facilities and Controls.
  6. Material and Equipment.
  7. Substitutions and Product Options.
  8. Contract Closeout:
    - a. Project Record Documents. Keep up to date marked up Drawings on site.
    - b. Operations and Maintenance Data.
    - c. Start-up.

- C. Related work provided in Divisions 2 through 14:
  - 1. Pipe chases and formed concrete work except as specified hereunder.
  - 2. Framed openings in masonry, concrete, wood and other architectural and structural elements.
  - 3. Wood grounds and nailing strips in masonry and concrete.
  - 4. Installation only of access panels in ceilings, walls, etc. Provide access panels as part of mechanical work.
  - 5. Painting except as specified hereunder.
  - 6. Curbs and roof flashings for openings through roofs, except for roof drain and vent pipe flashing.
  
- D. Related Work provided in Division 26 and 28:
  - 1. Motor disconnect switches and installation except as specified herein.
  - 2. Motor starters and installation except as herein specified.
  - 3. Power wiring except as specified herein.

#### 1.4 QUALITY ASSURANCE:

- A. Regulatory Requirements:
  - 1. All work, installations, materials and equipment shall comply with the provision of the following codes, standards and regulations, except where more stringent requirements are shown or specified:
    - a. State of Oregon International Mechanical Code. (IMC)
    - b. State of Oregon Plumbing Specialty Code. (UPC)
    - c. State of Oregon Structural Specialty Code. (IBC)
    - d. National Electrical Code. (NEC)
    - e. National Fire Protection Agency. (NFPA)
    - f. All City, County, State and Federal applicable laws and regulations.
    - g. Regulations and standards set forth by ASME, ASHRAE, SMACNA, AGA and ARI.
  - 2. Should there be any direct conflict between Codes and the Drawings and Specifications, the Codes, rules and regulations shall govern.
  - 3. Where two or more codes or regulations apply, the more stringent of the two shall be exercised.
  - 4. Should the Documents indicate a condition, which will conflict with the Codes, the Contractor shall inform the Owner's Representative and refrain from installing that portion until resolved. Any work installed in violation of the Codes will be removed and correctly installed as part of the Contract work.
  - 5. If the Drawings and Specifications indicate a higher quality than code, the Drawings and Specifications shall govern.
  - 6. Electrical products shall bear the U.L. label.
  
- B. The entire mechanical system shall operate correctly at full capacity without objectionable noise, vibration or decrease of efficiency.

## C. Materials and Equipments:

1. Equipment furnished shall meet all requirements of the Drawings and Specifications and be suitable for the installation. Equipment not meeting all requirements will not be acceptable.
2. Where two or more units of the same class of equipment are furnished, use products of the same manufacturer.
3. Furnish all materials and equipment, new and of size, type and quality herein specified.

## D. Workmanship:

1. Follow manufacturers' instructions. If they are in conflict with the Drawings and Specifications, obtain clarification from the Architect prior to beginning the work.

## E. Cutting and Patching:

1. Provide for cutting, patching and repairing for the installation of the work specified, including masonry work, concrete work, carpentry work and painting. Work shall be performed by skilled craftsmen of the respective trade.

## 1.5 DRAWINGS:

- A. The Drawings and Specifications are complementary and what is called for by one shall be as if called for by both. All items shown on the Drawings are not necessarily included in the Specifications. All directives and instructions to furnish, provide, install, complete and test described in the design documents shall be interpreted as directives unless clearly specified otherwise.
- B. Bring obscure or questionable items to the attention of the Owner's Representative prior to bid date. Necessary directions and explanations will be given by the Owner's Representative in Addendum Form.
- C. Should the Documents indicate a condition which will conflict with the Governing Codes and Regulations, the Contractor shall refrain from installing that portion of the work until receiving verification from the Owner's Representative. Should rearrangement or rerouting of duct or piping be necessary, provide for approval the simplest layout possible for that particular portion of the work. Any work installed in violation of the Governing Codes will be removed and correctly installed by the Contractor as part of the Contract work.
- D. Drawings are diagrammatic. They do not show every offset, bend, tee, or elbow which may be required to install work in the space provided. Do not scale drawings for roughing-in measurements, nor use as shop drawings. Make field measurements and prepare shop drawings as required. Coordinate work with shop drawings of other trades. Provide any bends, offsets and elbows where required by local conditions from measurements taken at the Building (subject to approval) and without additional cost to the Project. The right is reserved to make any reasonable changes in outlet location prior to rough-in.

- E. It is the intent of these specifications that the field wiring of all systems provided and modified under this contract shall be complete and operable. Refer to all drawings and specifications, especially the electrical drawings, to determine voltage, phase, circuit ampacity and number of connections indicated. Bring to the attention of the Engineer all conflicts, incompatibilities and discrepancies prior to bid.
  - F. Where equipment is shown, dimensions have been taken from typical equipment of the class indicated. Carefully check the Drawings to see that the equipment under consideration for installation will fit the space provided and that all connections may be made thereto without impairment of space and height requirements and of Code required clearances. Contractor is responsible for all changes required by equipment dimensions different than those shown.
  - G. Where equipment manufacturer and model number are listed it is the most recent and/or desired to describe function and quality of equipment to be supplied and installed. Since manufacturers may change model numbers without notification, should the model specified be unavailable, furnish and install the model number that is equal to or better than the one listed.
  - H. The location of all utilities, wires, conduits, pipes, duct, or other service facilities are shown in a general way only on the Drawings and are taken from existing public records. Ascertain whether any additional facilities other than those shown on the plans may be present and determine the exact location and elevations of all utilities prior to commencing installation.
  - I. Prior to bid, contact the local utility companies to verify requirements. Provide all material and labor by utilities.
  - J. The Contractor, before submitting a Bid on the work, must visit the site to become familiar with all visible existing conditions. As a result of having visited the premises, the Contractor shall be responsible for the installation of the work as it relates to such visible existing conditions. The submission of the bid will be considered an acknowledgement of the part of the Bidder of visitation to the site.
  - K. The Contractor is responsible to apply for and obtain all necessary permits, fees and inspections required by any public authority having jurisdiction. Refer to General Conditions for additional information.
- 1.6 SUBSTITUTION AND PRODUCT OPTIONS:
- A. See Division 1.
  - B. The use of manufacturer's names, models and numbers in the Drawings and Specifications is intended to establish style, quality, appearance and usefulness. The model numbers listed are the last available to the designer, if no longer current, substitute equipment equal to or better than that represented by the model number listed. Items noted "or equivalent" will require prior acceptance.
  - C. Submit for the Owner's Representative's review, manufacturer's detailed specifications and data sheets for all proposed substitutions. Submittals shall consist of a single sheet, or specific data need for consideration of approval. All pertinent data listed in the Specifications and on the Drawings shall be furnished, including all special features. See that all submittals are in proper order, and that all equipment will fit the space provided.

- D. All requests for approval of substitutions for materials other than those specified must be submitted in accordance with Instruction to Bidder.
- E. Substitution products from approved manufacturers do not need prior approval. Ensure substitutions meet all requirements of the Specifications.
- F. All changes required due to product substitutions are the responsibility of the Contractor.

#### 1.7 PROJECT RECORD DRAWINGS:

- A. Obtain drawings from Architect.
- B. Keep Drawings clean, undamaged and up to date.
- C. Record and accurately indicate the following:
  - 1. Depths, sizes and locations of all buried and concealed piping.
  - 2. Locations of all clean-outs.
  - 3. Changes, additions and revisions due to contract modifications.
  - 4. Locations of tracer wire terminal points.
- D. Drawings to be available for Architect review.
- E. Submit as a part of Project Closeout Documents

#### 1.8 PROJECT CONDITIONS:

- A. Existing Conditions: Prior to bidding, verify and become familiar with all existing conditions by visiting the site and include all factors which may affect the execution of this work. Include all related costs in the initial bid proposal.
- B. Coordinate exact requirements governed by actual job conditions. Check all information and report all discrepancies before fabrication work. Report changes in the time to avoid unnecessary work. Make changes as directed by Owner's Representative.

#### 1.9 CONTRACT MODIFICATIONS:

- A. In addition to the requirements of the General provisions, all supplemental cost proposals for this Division of work shall be accompanied by a complete itemized breakdown of labor and materials for each item. No exceptions will be made. Contract's estimating sheets for supplemental cost proposals shall be made available upon request. Labor must be separated and allocated to each item of work. Changes or additions subject to additional compensation made without written authorization based on agreed price shall be at Contractor's own risk and expense.

#### 1.10 STORAGE AND HANDLING:

- A. Delivery: Deliver to project site with manufacturer's labels intact and legible.

- B. Handling: Avoid damage.
- C. Storage: Store material inside, protected from weather, dirt and construction dust. Where necessary to store outside, elevate well above grade and enclose with durable, waterproof wrapping.

1.11 WARRANTY:

- A. Provide a written guaranty covering the work of this Division for a period of one calendar year from the date of acceptance of the entire project as required by the General Provisions.
- B. Provide manufacturer's written warranties for material and equipment furnished under this Division insuring parts and labor for a period of one year from the date of acceptance of the entire project.
- C. Correct warranty items promptly upon notification.

1.12 OPERATIONS AND MAINTENANCE DATA:

- A. Prior to final inspection, provide three (3) copies of manufacturer's maintenance manuals for each piece of equipment or items requiring service. Manual shall include manufacturer's operation and maintenance instruction manuals and parts list for each piece of equipment or item requiring servicing. Include in the manual manufacturer's service data, wiring diagrams and parts lists for all major items of equipment, valve charts, balancing data, final control diagrams showing final set points and any additional equipment added by contract modification. Comply with provisions of Section 01700 where applicable.
- B. Submit bound in 8-1/2 x 11 inch text pages, three ring binders with durable plastic covers.
- C. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
- D. Internally subdivide the binder contents with permanent page dividers, logically organized with tab titling clearly printed under reinforced laminated plastic table.

1.13 SUBMITTALS:

- A. Shop Drawings: The Contract Drawings indicate the general layout of the piping, ductwork and various items of equipment. Prepare and submit for review Shop Drawings of all installation not detailed on the Contract Drawings and all changes to the Contract Drawings.
- B. Product Data:
  - 1. Submit for review manufacturer's detailed shop drawings, specifications and stat sheets for all equipment to be furnished, as well as any wiring diagram showing field installed wiring and devices. Arrangement of mechanical equipment has been based on items of specific manufacturer intended as somewhat typical of several makes, which may be approved.

2. Indicate construction, capacities, accessories, etc. Manufacturer's abbreviations or codes are not acceptable.
  3. List the name of the motor manufacturer for each piece of equipment.
- C. Submission Requirements:
1. Shop Drawings and Product Data:
    - a. Submit all equipment and product data for Work of Division 23 together in a group in a 3-ring loose-leaf binder, with each item field under a tab, and labeled with its respective specification section number, article and paragraph, and mark if applicable.
    - b. Include a complete index in the original submittal. Indicate both original items submitted and note stragglers that will be submitted at a later date to avoid delay in submitting.
    - c. Additional product data submitted after return of the original binder shall include a tab similar to the originally submitted. Upon receipt of the return submittal, insert them in the previously submitted binder.
    - d. Refer to Division 1 for number of shop drawing copies to be submitted.
  2. Sample: Submit samples required by each Section of Division 23 at the same time that shop drawings and product data are submitted.
- D. It shall be the Contractor's responsibility to:
1. See that all submittals are in proper order.
  2. Ensure that all equipment will fit in the space provided.
  3. Assure that all deviation from Drawings and Specification are specifically noted and called to the attention of the Engineer/Architect/Contracting Officer in the submittals. Failure to comply will void approval automatically.
  4. Deviation, discrepancies, and conflicts between the submittals and the contract documents discovered prior to or after the review process shall not relieve the Contractor of this responsibility to comply with the contract documents.
- E. Electronic Submission Requirements:
1. Shop Drawings and Product Data:
    - a. Submit all equipment and product data for Work of Division 15 together in a group in a single PDF format file, with each item filed behind a cover sheet, and labeled with its respective specification section number, article and paragraph, and mark if applicable.
    - b. Include a complete index in the original submittal. Indicate both original items submitted and note stragglers that will be submitted at a later date to avoid delay in submitting.
    - c. Additional product data submitted after return of the original file shall include a cover sheet similar to that originally submitted. Upon receipt of the return submittal, insert them in the previously submitted electronic file.
    - d. Submission of overall line or general catalog data will not be accepted, submittals must be tailored to specific model being submitted on.

- e. Indication of unit, model, features, etc being submitted must be marked by bold arrow, bold circle or other clear means that will reproduce in black and white. Use of highlights, colored text or other colored indicators cannot be used.
- f. Electronic submissions review and comment will be in electronic PDF format only. Submission in an electronic format will be considered acceptance of this review process and format.
- g. Refer to Division 1 for number of shop drawing copies to be submitted.

#### 1.14 START-UP:

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Owner's Representative seven days prior to start-up of each item.
- C. Verify that each piece of equipment of system has been checked prior to start-up for proper lubrication, drive rotation, belt tension, control sequence, or other conditions, which may cause damage.
- D. Verify that tests, meter readings and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are completed and tested.
- F. Execute start-up under supervision of responsible manufacturer's representative or Contractor's personnel in accordance with manufacturer's instructions.

#### 1.15 FEES, PERMITS AND INSPECTIONS:

- A. The Contractor is responsible to apply for and obtain all necessary permits, fees and inspections required by any public authority having jurisdiction. Refer to General Conditions for additional information.

#### 1.16 DEFINITIONS:

- A. "Furnish: Means to supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations.
- B. "Install": Describes operations at project site including actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations.
- C. "Provide": Means to furnish and Install, complete and ready for intended use.

## PART 2 - PRODUCTS

## 2.1 MATERIAL:

- A. All materials and products used for construction shall be new, of the best grade, and latest products as listed in printed catalog data. All articles of a kind shall be the standard product of a single manufacturer. Trade names and manufacturers names denote a character and quality of equipment desired and shall no be construed as limiting competition.
- B. Asbestos: Do not use products made of or containing asbestos.

## 2.2 QUALITY ASSURANCE:

- A. Refer to Section 01640 Material and Equipment for information regarding available alternatives to materials and equipment specified herein. Product listings are for informational purposes only and establish a general standard of quality.
- B. Provide products which are compatible with other portions of the work and provide products with the proper and correct power and fuel burner characteristics and similar adaptations for the project.

## 2.3 INSPECTION:

- A. All work and materials are subject to field observation at any and all times by the Owner's Representative.
- B. The Contractor shall notify the Owner's Representative a minimum of two days prior to testing any piping system which must be witnessed and accepted before it is covered up or enclosed.
- C. If an observer finds any material or work not conforming to these Specifications, within three days after being notified, remove the materials from the premises and replace with approved materials. If the material has been installed, the entire expense of removing and replacing shall be borne of the Contractor.

## PART 3 - EXECUTION

## 3.1 EQUIPMENT PROTECTION:

- A. Keep pipe, ductwork and conduit openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect piping, conduit, ductwork, fixtures, equipment and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore damaged or contaminated fixtures, equipment or apparatus to original conditions or replace at no cost to the Owner.
- B. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.

- C. Cover or otherwise suitably protect equipment and materials stored on the job site.

### 3.2 CLEANING:

- A. General: Clean mechanical and plumbing equipment, fixtures, piping and ductwork of stampings and markings (except those required by codes), iron cuttings, and other refuse.
- B. Painted Surfaces: Clean scratched or marred painted surfaces of rust or other foreign mater and paint with matching color industrial enamel, except as otherwise noted.
- C. Before operating any equipment or systems, make thorough check to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated and serviced. Check factory instructions to see that installations have been made accordingly and that recommended lubricants have been used.
- D. Use particular care in lubricating bearings to avoid damage by over-lubrication and blowing out seals. Check equipment for damage that may have occurred during shipment, after delivery or during installation. Repair damaged equipment as approved or replace with new equipment.

### 3.3 LAYOUT AND COORDINATION:

- A. Site Examination: Before starting work, carefully examine site and all contract Drawings so as to become thoroughly familiar with conditions governing work on this project. Verify all indicated elevations, building measurements, roughing-in dimensions and equipment locations before proceeding with any of the work.
- B. The existence of any wires, conduits, pipes, ducts or other service facilities are shown in a general way only. It will be the duty of the Contractor to visit the site and make exact determination of the existence of any such facilities prior to submitting a bid. It is understood that the Contractor will be responsible for making the exact determination of the location and condition of these facilities.
- C. The location of all utilities indicated on the plans is taken from existing public records. The exact location and elevation of all public utilities must be determined by the Contractor It shall be the duty of the Contractor to ascertain whether any additional facilities other than those shown may be present.
- D. Sleeves, Insets, Cast-in-Place Work: provide sleeves, inserts, anchoring devices, cast-in-place work, etc. which must be set in concrete sequenced at the proper time for the project schedule.
- E. Coordination:
  - 1. Where the work must be sequenced and positioned with precision in order to fit into the available space, prepare accurate scale shop drawings showing the actual physical dimensions required for the installation and submit prior to purchase-fabrication-installation of any of the elements involved in the coordination.
  - 2. Cooperate with other trades in furnishing material and information for sleeves, bucks, chases, mountings, backing, foundations and wiring required for installation of mechanical items.

3. Coordinate all work with other trades and determine in advance where interfacing of the mechanical work and other work are required to be connected together. Provide all materials and equipment to make those connections. Submit shop drawings showing required connections where special conditions exist.
- F. Discrepancies: Report immediately any error, conflict or discrepancy in Plans, Specifications and/or existing conditions. Do not proceed with any questionable items of work until clarification of same has been made. Should rearrangement or re-routing of ducts or piping be necessary, provide for approval the simplest layout possible for that particular portion of the work.
- 3.4 TEMPORARY FACILITIES AND CONTROLS:
- A. Comply with Division 1 requirements.
  - B. Permanent mechanical systems' equipment utilized for temporary heating, ventilating and cooling shall be started with all controls and safeties installed and operational. Start-up shall be done by a factory approved mechanic only.
  - C. Owner's warranties shall not be abridged by Contractor's use of the permanent systems' equipment prior to final acceptance. Warranty period shall begin at final completion.
- 3.5 MECHANICAL WORK CLOSEOUT:
- A. General: Refer to the Division 1 sections for general closeout requirements. Calibrate all equipment requiring same.
  - B. Record Drawings: Submit record set of drawings required in Division 1, Submittals and as previously specified in this Section.
  - C. Closeout Equipment/Systems Operations: Sequence operations properly so that work of project will not be damaged or endangered. Coordinate with seasonal requirements. Operate each item of equipment and each system in a test run of appropriate duration with the Architect present, and with the Owner's operating personnel present, to demonstrate sustained, satisfactory performance. Adjust and correct operations as required for proper performance. Clean and lubricate each system, and replace dirty filters, excessively worn parts and similar expendable items of the work.
  - D. Operation and Instruction: Provide sixteen (16) hours of on-site training to Owner's personnel on all mechanical systems and equipment. Training shall include maintenance, lubrication, troubleshooting and repair. Contractor shall provide necessary written manuals and training aides explaining operational diagrams, emergency and alarm provisions, sequencing requirements, seasonal provisions, security, safety and similar features of the installed system. Three (3) copies of written manuals shall be left with Owner at end of training.

END OF SECTION

## SECTION 23 0500 - BASIC MATERIALS AND METHODS

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES:

- A. Items common to more than one section of Division 15 and general construction procedures and products. Work described in this Section applies to all Sections of Division 23.

## 1.2 STORAGE AND HANDLING:

- A. Deliver materials to the project site with manufacturer's labels intact and legible. Handle materials with care to avoid damage. Store materials inside protected from weather, dirt and construction dust. Where necessary to store outside, elevate well above grade and enclose with durable, waterproof wrapping. Label equipment as soon as it arrives at job site.

## 1.3 SUBMITTALS:

- A. Submit product data under provisions of Section 23 0000 and Division 1.
- B. Provide submittals for:
  - 1. Motors.
  - 2. Starters.
  - 3. Pipe sleeves
  - 4. Escutcheons.
  - 5. Equipment Identification.

## PART 2 - PRODUCTS

## 2.1 QUALITY ASSURANCE:

- A. Refer to Division 1 Material and Equipment for information regarding available alternatives to materials and equipment specified herein. Product listings are for informational purposes only and establish a general standard of quality.
- B. Provide products which are compatible with other portions of the work and provide products with the proper and correct power and fuel burner characteristics and similar adaptations for the project.

## 2.2 MATERIALS:

- A. All materials and products used for construction shall be new, of the best grade, and the latest products as listed in printed catalog data.

- B. All articles of a kind shall be the standard product of a single manufacturer.
- C. Provide products which are compatible with other portions of the work and products which have the proper electrical power and fuel-burning characteristics for this project.
- D. Trade names and manufacturers names denote the character and quality of equipment desired and shall not be construed as limiting competition.

### 2.3 ELECTRIC MOTORS:

- A. Enclosure Type: Open drip-proof for normal concealed indoor use, guarded where exposed to employees or occupants. Type II for outdoor use, except weather-protected Type I where adequately housed.
- B. Bearings: Ball or roller bearings, and design for thrust where applicable; permanent or pressure lubricated anti-friction. Sleeve-type bearings permitted only where indicated for light-duty fractional horsepower motors.
- C. Construction: General purpose, continuous duty; NEMA design "B", except "C" for high starting torque applications.
- D. Frames: For single phase motor sizes NEMA No. 48, except 56 for heavy-duty applications. NEMA "T" frames for 1 horsepower and larger polyphase motors.
- E. Phases and Current: 1/3 horsepower and smaller capacitor-start single-phase; 1/2 horsepower and larger, squirrel-cage induction polyphase. Coordinate with actual current characteristics; specified in Division 16 and do not use 230/460 voltage motors on 208 voltage power or vice versa.
- F. Service Factor: 1.35 for single-phase; 1.15 for polyphase.
- G. Overload Protection: Built-in thermal with internal sensing device for stopping motor, and for signaling where indicated on single phase motors.
- H. Speed: Not faster than synchronous speeds of 1800 RPM except where otherwise indicated.
- I. Temperature Rating: Class B insulation, except where otherwise indicated or required for service indicated.
- J. Starting Capability: As required for service indicated, but not less than 5 starts per hour.
- K. Efficiency: The manufacturer's highest efficiency motors tested under procedures recommended by NEMA Premium (IEEE Standard 112, Test Method B). Minimum 84% efficiency at 3 HP increasing to 90% above 15 HP. Submit manufacturer's data if motor nameplate does not indicate minimum efficiency.
- L. Manufacturers: Century, General Electric, Lincoln, Louis Allis, Baldor, Wagner, Westinghouse or accepted substitute. Where selection of motor manufacturer is within Contractor's control (independent of mechanical equipment selection), provide motors produced by a single manufacturer.

- M. VFD duty: Provide inverter type with shaft grounding rings.

#### 2.4 STARTERS AND SWITCHES:

- A. General: Provide each motor with starter or switch as approved and recommended by manufacturer of motor or equipment of which motor is a part.
- B. Magnetic Starters: Provide for ½ horsepower and larger motors, and for smaller motors on automatic control or with interlock switch. Include pilot lights, reset, trip-free relay on each phase, Hand-Off-Auto switch in cover, and devices for coordination with control system (including transformer for control circuit, verify holding coil voltage requirements with control system design). Provide automatic ambient temperature compensation for starter heaters.
- C. Manual Switches: Provide on motors 1/3 horsepower and smaller except where automatic control or interlock is indicated. Include pilot light. Provide overload protection where not protected by panel board circuit breaker or fused disconnect switch.
- D. Starter Characteristics: Type I general purpose enclosure with padlock ears and mounting supports. Starter type and size as recommended by motor manufacturer.
- E. Manufacturers: General Electric, ITE, Allen Bradley, Cutler-Hammer, Square D or accepted substitute.

#### 2.5 ELECTRICAL EQUIPMENT:

- A. Equipment Wiring: Interconnecting wiring within or on a piece of mechanical equipment shall be provided with the equipment unless required otherwise. Provide all necessary field wiring and devices from the point of connection indicated on the electrical drawings to each equipment item.
- B. Control Wiring: All control wiring for mechanical equipment shall be provided under Section 23 0923 or 23 0933, Controls and Instrumentation.
- C. Codes: All electrical equipment and products shall bear the U.L. and/or C.S.A. label as required by governing codes and ordinances. Refer to paragraph 1.3, Quality Assurance for definition of testing agency certification requirements.

#### 2.6 DRIVES:

- A. General: “V” section belt drives, multiple as required, sized on 1.5 times installed motor horsepower. Provide variable pitch motor sheaves on all one or two belt drives and standard slide rails or approved means of adjustment for each motor with belt drive. Use standard section belts and no sheave smaller than cataloged industry standard; provide countersunk center on shaft ends to receive speed counter tip.
- B. Manufacturers: Dayton, Gates, Browning, or accepted substitute.

## 2.7 MACHINERY GUARDS:

- A. Furnish guards for protection on all rotating and moving parts of equipment. Provide guards for all metal fan drives and motor pulleys, regardless of being enclosed in a metal cabinet.
- B. Design guards so as not to restrict air flow at fan inlets resulting in reduced capacity.
- C. Provide 2-1/2 inches diameter access opening holes in guards for easy use of tachometers at pulley centers. Guards shall be easily removable for pulley adjustment or removal and changing of belts.
- D. All guards shall meet OSHA requirements including back plates.

## 2.8 ACCESS PANELS:

- A. Access panels shall have same fire rating as surface where mounted.
- B. Provide flush key cylinder locks on all access panels less than 8 feet above the floor in public spaces. Turn keys over to Owner at project completion. Screwdriver latches on all others.
- C. Steel, 24" x 24" or as required. Complete with steel frame, hinged locating door, and prime coat finish. Type to match building construction.
- D. Manufacturers: INRYCO/MILCOR Style DW, K or M panels as required by construction. Bilco, Potter-Roemer or accepted substitute.

## 2.9 PIPE SLEEVES:

- A. Interior Wall Sleeves: 12 gage galvanized steel, flush with wall on both sides.
- B. Interior Floor Sleeves: 12 gage galvanized steel and extend 2-inches above finished floor.
- C. Exterior Wall Sleeves: Cast iron, flush with wall on both sides.
- D. On Grade Floor Sleeves: Same as exterior wall sleeves.

## 2.10 ESCUTCHEONS:

- A. Brass material, chrome plated finish. Size sufficient to cover all pipe openings through wall, floor or ceiling. Set screw or spring to secure to pipe.

## 2.11 UNIONS:

- A. Steel pipe union shall be 150-pound malleable iron, brass to iron seat, ground joint, black or galvanized to match pipe.
- B. Copper pipe union shall be 200 psig working pressure. Bronze body. Solder ends.

- C. Insulating unions shall be 250 psig working pressure. Pipe ends and material to match piping. Electric current below 1% of galvanic current. Gasket material as recommended by manufacturer. Epco or approved.

#### 2.12 ROOF FLASHING:

- A. Use flashing products specifically designed for and compatible with metal roofing system used.

#### 2.13 MISCELLANEOUS STEEL:

- A. Provide steel as required for adequate support of all mechanical equipment, angle or channel, I or H sections as required by application. Provide suitable base plates for stands and anchors for hanging equipment. Drill support holes only in flanges of structural center of length as possible. Apply one coat of black rust inhibitive enamel primer to shop fabricated items before delivery to job; other painting as specified herein. Provide shop drawings of supports especially constructed for this project. Burning of holes is not permitted.

#### 2.14 PAINTING:

- A. Apply one coat of black rustoleum primer to shop fabricated items before delivery to job. Other painting as specified herein.

#### 2.15 IDENTIFICATION MARKERS:

##### A. Nameplates:

1. Engraved nameplates, 1/16 inches thick, laminated 3-ply plastic, center ply white, outer ply black, letters formed by exposing center ply.
2. Size: 3 inches by 5 inches nameplates with 1/4-inch high letters.
3. Manufacturers: Lamicoid. Seaton, Brady, Zeston or accepted substitute.

##### B. Lettering and Graphics:

1. Coordinate names, abbreviations and other designations used in mechanical identification work with designations shown or scheduled. Provide numbers, lettering and wording as indicated for identification of mechanical systems and equipment.
2. Multiple Systems: Where multiple systems of same name are shown provide identification which indicates individual equipment number as well as service (examples: Chiller (CH) No. 1, Chiller (CH) No. 2, Air Conditioning Unit No. 1 (AC) No. 1, Air Conditioning Unit (AC) No. 2.)

## PART 3 - EXECUTION

## 3.1 ACCESS PANELS:

- A. Furnish and install access panels required for mechanical work. Access panels shall have same fire ratings as surface where mounted. Furnish panels of adequate size for valves and equipment requiring service and installed above ceilings, behind walls or in furring, complete with correct frame for type of building construction involved. Exact size, number and location of access panels are not necessarily shown. Use no panel smaller than 12 inches by 12 inches for simple manual access or smaller than 16 inches by 20 inches where personnel must pass through. Paint with color and finish to match surrounding architectural features, where exposed.

## 3.2 PIPE SLEEVES:

- A. Sleeves: Large enough in diameter to provide ¼-inch clearance around pipes or insulation. Caulk with watertight rated, UL listed foam-in-place barrier.
- B. Layout: Lay out work in advance of pouring of slabs or construction of wall and furnish and set inserts and sleeves necessary to complete the work.
- C. Coordination: Cutting or patching required as a result of lack of coordination of this operation shall be at no change in contract amount.

## 3.3 FLOOR, WALL AND CEILING ESCUTCHEONS:

- A. Install on piping passing through finished walls, floors, ceilings, partitions and plaster furrings. Escutcheons shall completely cover opening around pipe.
- B. Secure wall and ceiling escutcheons to pipe or structure.
- C. Escutcheons shall not penetrate insulation vapor barriers.
- D. Escutcheons not required in mechanical rooms or unfinished spaces.

## 3.4 MECHANICAL EQUIPMENT WIRING:

- A. Provide all mechanical equipment motors, automatic temperature, limit, float and similar control devices required, with wiring complete from power source indicated on Electrical Drawings.
- B. Provide properly rated motor overload and under voltage protection and all manual or automatic motor operating devices for all mechanical equipment.
- C. Equipment and systems shown on the Drawings and/or specified, are based upon requirements of specific manufacturers which are intended as somewhat typical of several makes which may be approved. Provide all field wiring and/or devices necessary for a complete and operable system including controls for the actual selected equipment/system.

- D. Provide all starters for mechanical motors. Review Electrical Specifications and Drawings to determine which mechanical motor starters will be provided under the Electrical Specification Sections and provide all others.

### 3.5 PAINTING:

- A. General: Coordinate painting of mechanical equipment and items with products and methods specified under Section 09900, Painting.
- B. Painting Materials: material shall comply with Section 09900, Painting.
- C. Uninsulated Piping: Paint black or galvanized uninsulated piping located buried in ground, in concrete or masonry one (1) coat acid-resisting black paint. Paint black or galvanized uninsulated piping in moist equipment rooms, crawl spaces without vapor barriers or exposed to weather one (1) coat black asphaltum varnish.
- D. Iron Work: Paint hangers, rods, anchors, guides, threads of galvanized pipe, bases, supports, uncoated sheet metal and other iron work without factory finish, exposed to weather, located in moist concealed spaces and moist equipment rooms one coat acid-resisting black paint. Apply one (1) coat Dixon's Aluminum Graphite No. 209 paint over the (1) coat primer as recommended by paint manufacturer to all hot metal surfaces.
- E. Sheet Metal: Apply one coat of zinc chromate to mechanical sheet metal exposed to weather, except no painting required on aluminum or stainless steel. Apply one coat of flat black paint to the inside of unlined ducts behind all grilles and registers.
- F. Insulated Piping and Other Insulated Surfaces: Paint insulated piping in half-round, split tile, or other inaccessible locations, one (1) coat asphalt emulsion.

### 3.6 MECHANICAL SYSTEM IDENTIFICATION:

- A. Each new piece of equipment shall bear a permanently attached identification plate, listing the manufacturer's name, capacities, sizes and characteristics. In addition to the manufacturer's identification plate, provide nameplates of black phenolic resin laminate and identify new equipment by name and number ½" high letters.

### 3.7 ACCESSIBILITY:

- A. Locate valves, thermometers, cleanout fittings and other indicating equipment or specialties requiring frequent reading, adjustments, inspection, repairs and removal or replacement conveniently and accessibly with reference to the finished building.
- B. Thermometers and Gages: Install thermometers and gages so as to be easily read from the floors, platforms and walkways.

### 3.8 INSTALLATION:

- A. Locating and Positioning Equipment: Comply with all Codes, Regulations and observe good common practice in locating and installing mechanical equipment and material so that completed installation presents the least possible hazard. Maintain adequate clearances for repair, service and operation to all equipment and comply with Code requirements. Set all equipment level or as recommended by manufacturer.
- B. Arrangement: Arrange ductwork and piping parallel with primary lines of the building construction, and with a minimum of 7' overhead clearance in all areas where possible. Conceal all piping and ductwork. Locate operating and control equipment properly to provide easy access. Give right-of-way to piping which must slope for drainage. Set all equipment level as recommended by manufacturer. Under no conditions shall beams, girders, footings or columns be cut for mechanical items. Casting of pipes into concrete is prohibited unless so shown on Drawings.
- C. Anchorage: Anchor and/or brace all mechanical equipment, piping and ductwork to resist displacement due to seismic action, include snubbers on equipment mounted on spring isolators.
- D. Drip Pans: Provide drip pans under all above ceiling in-line pumps and cooling coils. Locate pan immediately below piping and equipment and extend a minimum of 6 inches on each side and lengthwise 18 inches beyond equipment being protected. Fabricate pans 2 inches deep, or reinforced sheet metal (20 gauge copper, or 16 gauge steel with 2 ounces zinc finish hot dipped after fabrication) with rolled edges and soldered or welded seams. Provide 3/4 inch copper drainage piping, properly discharged to over floor drain or as shown on the Drawings. Comply with Mechanical Code overflow protection and pipe sizing.
- E. Adjusting: Adjust and calibrate all automatic mechanical equipment, mixing valves, flush valves, float devices, etc. Adjust flow rates at each piece of equipment or fixture.
- F. Building Vapor Barrier: Wherever the building insulation vapor barrier is penetrated by mechanical piping, hangers, conduits, ductwork, etc., provide clear self-adhesive tape recommended by the insulation manufacturer around the penetrations.

### 3.9 SYSTEM ADJUSTMENT:

- A. Adjust and calibrate all automatic mechanical equipment, mixing valves, float devices, etc. Adjust flow rates at each piece of equipment or fixture. Open and close all shutoff and control valves several times to insure tight glands.

### 3.10 CUTTING AND PATCHING:

- A. General: Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of mechanical work. Do all necessary cutting and patching of existing yard surfaces required for completion of the mechanical work. Patch to match finish and color of adjacent surfaces.

END OF SECTION

## SECTION 23 0529 - SUPPORTS AND ANCHORS

## PART 1 - GENERAL

## 1.1 WORK INCLUDED:

- A. Provide pipe and equipment hanger, support, anchors and all related items for complete systems.

## 1.2 QUALITY ASSURANCE:

- A. Provide pre-manufactured horizontal piping and ductwork hangers, clamps, hanger rod, shields, supports, etc.
- B. Seismic requirements: Provide seismic restraints in accord with the latest edition of "Seismic Restraint Manual Guidelines" as published by SMACNA. Seismic Hazard Level (SHL) of "A". A lower SHL will be allowed provided the contractor provides calculations stamped by a registered professional structural engineering in the state the project is located indicating a lower SHL is acceptable.

## 1.3 SUBMITTALS:

- A. Submit product data under provisions of Section 23 0500.
- B. Submit construction details, and performance characteristics for each type and size of anchor, hanger and support.

## PART 2 - PRODUCTS

## 2.1 HANGERS AND SUPPORTS:

- A. Listed Types: The Manufacturers Standardization Society (MSS) Piping Types listed with Grinnell figure numbers in parentheses where applicable (or another manufacturer's as noted). ITT Grinnell, Elcen, Michigan, Super Strut, Kindorf, Unistrut or accepted substitute.
- B. Horizontal Piping Hangers and Supports:
  - 1. Adjustable Clevis Hanger: MSS Type 1 (Fig. 260).
  - 2. Adjustable Band Hanger: MSS Type 7 (Fig. 97), fabricated from steel.
  - 3. Adjustable Swivel-Band Hanger: MSS Type 10 (Fig.70).
  - 4. Clamp: MSS Type 4 (Fig. 212, 216).

5. Double-Bolt Clamp: MSS Type 3 (Fig. 295A, 295H), including pipe spacers.
6. Pipe Anchors: (Carpenter & Peterson Fig. 145CI) Steel weld type to pipe for sizes up to 20 inches in diameter.
7. Single-Roll Support: MSS Type 42 (Fig. 174), including axle-roller and threaded sockets.
8. Adjustable Roller Hanger: MSS Type 43 (Fig. 181), including axle-roller and clevis.
9. Adjustable Roll/Base: MSS Type 46 Fig. 274), including roller, adjustable base and stand.
10. Rollers for Channel Support Systems: Grinnell Fig. 1901, 1902, 1911, 815, or 816 for pipe sizes up to 18 inches in diameter.
11. Sliding Support Base: MSS Type 35 (Grinnell 600 series). Base and guide.
12. Adjustable Saddle-Support: MSS Type 36 (Fig. 258) and MSS Type 37 (Fig. 259), including saddle, pipe and reducer. Fabricate base-support from steel pipe and include cast-iron flange or welded-steel plate.

C. Equipment and Piping Supports:

1. Channel Support System: Galvanized, 12 gauge channel and bracket support systems, single or double channel as indicated on the Drawings or as required by piping and equipment weights. Grinnell "Power "Strut" channel.
2. Steel Brackets: Welded structural steel shapes complying with one of the following:
  - a. Light Duty: MSS Type 31 (Fig. 194).
  - b. Medium Duty: MSS Type 32 (Fig. 195).
  - c. Heavy Duty: MSS Type 33 (Fig. 199).

D. Hanger Rod Attachment:

1. Hanger Rod: Right hand threaded, (Grinnell Fig. 140 or 146 for all sizes).
2. Turnbuckles: MSS Type 13 (Fig. 230).
3. Weldless Eye-Nut: MSS Type 17 (Fig. 290).
4. Malleable Eye-Socket: MSS Type 16 (Fig. 110R).
5. Clevises: MSS Type 14 (Fig. 299).

E. Building Attachments:

1. Concrete Inserts: MSS Type 18 (Fig. 282), steel or Grinnell Power-Strut PS349 continuous channel.
2. Clamps: MSS Type 19 (Fig. 285, 281), Type 20, 21 (Fig. 225, 226, 131), Type 23 (Fig. 86, 87,88), Type 25 (Fig. 227), Type 27 through 30 where applicable.

## 2.2 SADDLES AND SHIELDS:

- A. Listed Types: The Manufacturers Standardization Society (MSS) Piping Types listed with Grinnell figure numbers in parentheses where applicable (or another manufacturer's as noted).
- B. Protection Saddles: MSS Type 39 (Fig. 160).

- C. Protection Shields: MSS Type 40 (Fig. 167).
- D. Preinsulated Pipe Supports: Pipe Shields Inc. or accepted substitute.
  - 1. Pipe supported on rods - Model A1000, through A4000 and A9000.
  - 2. Pipe supported on flat surfaces - Model A1000, A2000, A5000 through A7000.
  - 3. Pipe supported on pipe rolls - Model A3000 through A6000 and A8000.

### 2.3 MISCELLANEOUS HANGER MATERIALS:

- A. Metal Framing: Provide products complying with NEMA STD ML 1.
- B. Steel Plates, Shapes and Bars: ASTM A-36.
- C. Cement Grout: Portland Cement (ASTM C-150, 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 only the minimum amount of water required for placement and hydration.
- D. Heavy Duty Steel Trapezes: Fabricate from steel shapes selected for the loads required; weld steel in accordance with AWS Standards.
- E. Pipe Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of a bolted two-section outer cylinder and base with a two-section guiding spider bolted tight to the pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of the length recommended by the manufacturer to allow indicated travel.
- F. Standard Bolts and Nuts: ASTM A 307, Grade A.
- G. Concrete Anchors: Rawl Lok/Bolt, Hilti "HSL," ITT Phillips, Red Head Wedge Anchors, Ramset Trubolt or Dynabolt or accepted substitute.
- H. Shop Primer: Manufacturer's standard rust inhibitive primer.

### 2.4 ROOF EQUIPMENT SUPPORTS:

- A. General: Coordinate the location and type of each roof equipment support with the roofing system supplier. Systems to maintain roof warranty. Minimum 18 gauge galvanized steel with fully mitered and welded corners, internal bulkhead reinforcing, integral base plates, pressure-treated wood nailer and 18 gauge galvanized steel counterflashing. Compensate for roof slope so top of support is level. Construct curb to meet or exceed all seismic forces.
- B. Manufacturers: Thycurb, Custom Curb, Vibrex or accepted substitute.

## PART 3 - EXECUTION

## 3.1 INSTALLATION OF HANGERS AND SUPPORTS:

- A. General: Proceed with the installation of hangers, supports and anchors only after the required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) the proper placement of inserts, anchors and other building structural attachments.
1. Install hangers, supports, clamps, and attachments to support piping and equipment properly from the building structure. Use no wire or perforated metal to support piping, and no supports from other piping or equipment. For exposed continuous pipe runs, install hangers and supports of the same type and style as installed for adjacent similar piping.
  2. Prevent electrolysis in the support of copper tubing by the use of hangers and supports which are copper plated, or by other recognized industry methods.
  3. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at panel points only.
  4. Install hangers and supports to provide the indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded. Comply with the following installation requirements:
    - a. Clamps: Attach clamps, including spacers (if any), to piping outside the insulated piping support. Do not exceed pipe stresses allowed by ANSI B31.
    - b. Insulated Pipe Supports: Insulated pipe supports shall be supplied and installed on all insulated pipe and tubing.
    - c. Load Rating: All insulated pipe supports shall be load rated by the manufacturer based upon testing and analysis in conformance with ASME B31.1, MSS SP-58, MSS SP-69 and MSS SP-89.
    - d. Support Type: Manufacturer's recommendations, hanger style and load shall determine support type.
    - e. Insulated Piping Supports: Where insulated piping with continuous vapor barrier or where exposed to view in finished areas is specified, install hard maple wood insulation shields (Elcen Fig. 216) or steel pipe covering protection shields (MSS type 39) at each hanger.
- B. Provisions for Movement:
1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units.
  2. Install hangers and supports so that equipment and piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- C. Pipe Hangers and Supports:
1. Vertical Spacing: Support at base, every floor height not exceeding 10 feet and required by Code and just below roof line.

- 2. Screwed or Welded Steel or Copper Piping: Maximum hanger spacing shall be as follows:

	Steel	Copper
1-1/4 inches and smaller	6 foot span	5 foot span
1-1/2 inch pipe	9 foot span	6 foot span
2 inch pipe	10 foot span	10 foot span
2-1/2 inch	11 foot span	10 foot span
4 inches and larger	12 foot span	10 foot span

- 3. Cast Iron Soil Pipe:
  - a. Hubless and Compression Joint: At every other joint except when developed length exceeds 4 feet, then at each joint.
  - b. Additional Support: Provide at each horizontal branch and/or at concentrated loads to maintain alignment and prevent sagging.
- 4. Install additional hangers or supports at concentrated loads such as pumps, valves, etc. to maintain alignment and prevent sagging.
- 5. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
- 6. Place a hanger within 12 inches of each horizontal elbow.
- 7. Support Rod: Hanger support rods sized as follows:

Pipe Size	Rod Diameter	Max. Load
2 inches and smaller	3/8 inch	610 lb.
2-1/2 to 3 inches	1/2 inch	1130 lb.
4 inches	5/8 inch	1810 lb.
6 inches	3/4 inch	2710 lb.
8 through 12 inches	7/8 inch	3770 lb.

- D. Adjust hangers and supports to bring piping to proper levels and elevations.
- E. Provide all necessary structural attachments such as anchors, beam clamps, hanger flanges and brackets in accordance with MSS SP-69. Attachments to beams wherever possible. Supports suspended from other piping, equipment, metal decking, etc., are not acceptable.
- F. Horizontal banks of piping may be supported on common steel channel member spaced not more than the shortest allowable span required on the individual pipe. Maintain piping at its relative lateral position using clamps or clips. Allow lines subject to thermal expansion to roll axially or slide. Size channel struts for piping weights.

3.2 INSTALLATION OF ANCHORS:

- A. Install anchors at the proper locations to prevent stresses from exceeding those permitted by ANSI B31, where recommended in SMACNA "Seismic Restraint Manual" or exceeding manufacturer's recommended loading, and to prevent the transfer of loading and stresses to connected equipment.

- B. Welding: Provide anchor by welding steel shapes, plates and bars to the piping and/or equipment and to the structure. Comply with ANSI B31 and AWS standards and SMACNA "Seismic Restraint Manual."
- C. Bolting: Provide standard plate washers under heads and nuts of bolts bearing on wood. Soap threads of lag bolts prior to installing.
- D. Structural Blocking: Locate as indicated and as required to support mechanical piping and equipment.
- E. Where expansion compensators are indicated, install anchors in accordance with the expansion unit manufacturer's written instructions, to limit movement of piping and forces to the maximums recommended by the manufacturer of each unit.
- F. Anchor Spacings: Install anchors at the ends of principal pipe runs, at intermediate points in pipe runs between expansion loops and bends. Make provisions for presetting of anchors as required to accommodate both expansion and contraction of piping.
- G. Painting: Refer to Section 23 0500.

### 3.3 ROOF EQUIPMENT SUPPORTS, EQUIPMENT CURBS AND PIPE CURB ASSEMBLIES:

- A. Provide prefabricated units for all roof penetrations for mechanical equipment. Set supports on the structural deck. Do not set supports on insulation or roofing. Provide level supports by prefabricated slope built into curb.
- B. Equipment supports: Provide for roof mounted equipment which does not require a structural roof deck penetration.
- C. Equipment Curbs: Provide for equipment which requires a structural roof deck penetration other than piping or conduit.
- D. Pipe Curb Assemblies: Provide for piping and electrical conduit which penetrates the roof deck to service equipment above the roof.

END OF SECTION

## SECTION 23 0594 - TESTING, ADJUSTING AND BALANCING

## PART 1 - GENERAL

## 1.1 SUMMARY:

- A. Work Included: Materials, equipment and labor required for testing, adjusting and balancing work required by this Section, including Air Distribution Systems and associated equipment and apparatus. The work consists of setting speed and volume (flow) adjustments, recording data, conducting tests, preparing and submitting reports and recommending modifications to work as required.
- B. Relates Documents: drawings and General Provisions of Contract, including general and Supplementary Conditions and Division 1 Specification Section, apply to work specified in this section.

## 1.2 QUALITY ASSURANCE:

- A. Codes and Standards:
  - 1. NEBB Compliance: Comply with NEBB's "Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems" as applicable to mechanical Air and Hydronic Distribution Systems and associated equipment and apparatus; or comply with AABC's Manual MN-1, "AABC National Standard," as applicable to equipment and apparatus.
  - 2. Industry Standards: Comply with ASRAE recommendations pertaining to measurements, instruments and testing, adjusting and balancing, except as otherwise indicated.

## PART 2 - PRODUCTS

## 2.1 TOOL, EQUIPMENT, INSTRUMENTS:

- A. Calibrate all instruments used for balancing within a period of six months and submit proof of such calibration to Mechanical Engineer if requested.

## 2.2 REPORTS AND RECORDS:

- A. Submit five copies of complete balancing report on forms similar in content to standard AABC or NEBB test forms. Provide with each report a complete set of marked balancing drawings showing air opening numbers that correspond to numbering system in balancing logs.

## PART 3 - EXECUTION

## 3.1 TESTING PROCEDURES – AIR SYSTEMS:

- A. Identify and list size, type and manufacturer of all air handling equipment and air distribution devices. Use manufacturer's published ratings on all equipment to make required calculations.
- B. Test adjust and record fan RPM to deliver within plus or minus 10 percent of air quantity specified. Plug all test holes.
- C. After all air flow measurements have been made, mark final position of balancing damper.
- D. Record nameplate data and actual running amperes for each fan motor.
- E. Test and record system static pressure, suction and discharge.
- F. Test and adjust system for design outside air and return air.
- G. Test and record entering and leaving air dry-bulb temperature for both heating and cooling cycles of each fan system.
- H. Test, adjust and record each diffuser, grille and register to within 10 percent of design requirements. Identify each grille, diffuser and register as marked on balancing drawings.

END OF SECTION

## SECTION 23 0700 - MECHANICAL INSULATION

## PART 1 - GENERAL

## 1.1 WORK INCLUDED:

- A. Provide piping, ductwork and equipment insulation including jacketing, adhesive and all related accessories for complete insulated system.

## 1.2 QUALITY ASSURANCE:

- A. Applicator: Company specializing in piping insulation application with three years minimum experience.
- B. Insulation, Jacket and all Related Materials: Flame spread rating of 25 and smoke developed rating of 50.
- C. Codes: Comply with all applicable codes.
- D. Installation: Install in accordance with Manufacturer's recommendations.
- E. Prohibited substances: The following substances are prohibited in the State of Oregon for use in manufacturing duct insulation, wraps, or covers and pipe insulation, wraps or covers. Products containing these substances are not allowed for use.
  - 1. Pentabrominated diphenyl ether CAS#32534-81-9.
  - 2. Octobrominated diphenyl ether CAS#32536-52-0.
  - 3. Decabrominated dphenyl ether CAS#1163-19-5.

## 1.3 SUBMITTALS:

- A. Submit product data and installation instructions under provisions of Section 23 0000.
- B. Include product description, list of materials and thickness for each service, and locations.

## 1.4 DELIVERY, STORAGE AND HANDLING:

- A. Deliver product to site under provisions of Section 23 0000.
- B. Store and protect product under provisions of Section 23 0000.
- C. Store insulation in original shipping container with labeling in place. Do not install damaged insulation.

## 1.5 FIRE HAZARD CLASSIFICATION:

- A. Maximum fire hazard classification of the composite insulation to be not more than a flame spread of 25, fuel contributed of 50 and smoke developed of 50 as tested by ASTM E84, NFPA 255 and UL 723 method.
- B. Test pipe insulation in accordance with the requirements of UL “Pipe and Equipment Coverings R5583 400 8.15.”, ASTM C1136 and ASTM C547.
- C. Test duct insulation in accordance with ASTM E84 and ASTM C1071 and bear the UL label.

## 1.6 LINING MATERIALS:

- A. Materials to be mold, humidity, and erosion resistant surface to meet the requirements of UL 181.

## PART 2 - PRODUCTS

## 2.1 ACCEPTABLE MANUFACTURERS:

- A. Insulating Manufacturers: Johns Manville, Knauf, Armstrong, Owens-Corning, Pabco, IMCOA, Certain Teed or accepted substitute.
- B. Adhesive Manufacturers: Benjamin Foster, 3M, Borden, Kingco or Armstrong.

## 2.2 DUCT INSULATION AND JACKETS:

- A. Duct Wrap: 1 1/2 inch flexible glass fiber; ANSI/ASTM C612; commercial grade; 'k' value of 0.27 at 75 degrees F. 1.0 pcf.
- B. Duct liner: ASTM 1071; flexible blanket. ‘K’ Value: ASTM C518, 0.25 at 75°F. Noise Reduction Coefficient: 0.65 or higher based on “Type A mounting.” Maximum Velocity on Mat or Coated Air Side: 5,000 FPM. Adhesive: UL listed waterproof type. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened. Mold, humidity, and erosion resistant surfaces: UL 181.
- C. Jacketing and Fasteners:
  - 1. Indoor Jacket: Foil-Skrim-Kraft.
  - 2. Outdoor Jacket: Coated glass fiber sheet, 30 lb/sq yd.
  - 3. Lagging Adhesive: Fire resistive to ASTM E84, NFPA 255, and UL 723.
  - 4. Impale Anchors: Galvanized steel, 12 gauge, self-adhesive pad.
  - 5. Joint Tape: Glass fiber cloth, open mesh.
  - 6. Tie Wire: Annealed steel, 16 gauge (1.5 mm).
- D. SoftR® Duct Wrap Paper-free ASJ and VaporWick® or equal approved.

**2.3 EQUIPMENT INSULATION:**

- A. Equipment Temperatures Below 70 deg. F: Flexible, closed cell, elastomeric sheet insulation of 5.5 #/cubit feet density and 0.27 thermal conductivity at 75 deg. F.
- B. Equipment Temperatures from 70 deg. F to 450 deg. F: Glass fiber 3 pound density insulation with a 0.23 thermal conductivity at 75 deg. F. Foil jacket or finished as recommended by manufacturer.
- C. Exterior Tanks and Equipment Insulation Covering: Same as interior insulation with weatherproof metal or finished as recommended by insulation manufacturer.

**2.4 DUCT INSULATION ACCESSORIES:**

- A. Staples, bands, wires, tape, anchors, and accessories as recommended by insulation manufacturer.

**2.5 DUCT INSULATION COMPOUNDS:**

- A. Cements, adhesives, coatings, sealers, finishes and accessories as recommended by insulation manufacturer.

**2.6 OUTDOOR DUCTING:**

- A. Aluminum Jacket: 0.016-inch thick sheet, smooth/embossed finish, with longitudinal slip joints and 2-inch laps.
- B. Nonwater vapor retarder, nonburning weatherproof coating for use over insulation where “breathing” is required.
- C. UV resistant polyvinyl chloride covering with joints secured and sealed.

**2.7 CANVAS JACKET:****PART 3 - EXECUTION****3.1 PREPARATION:**

- A. Install materials after piping, ductwork and equipment has been tested and approved.

**3.2 DUCTWORK INSULATION INSTALLATION:**

- A. Install materials in accordance with manufacturer's instructions.
- B. Installation:
  - 1. Butt insulation joints firmly together and install jackets and tapes securely.

2. Apply duct insulation continuously through sleeves and openings. Apply vapor barrier materials to form a vapor seal over the insulation.
3. Cover breaks in the jacket material with patches of the same material as the vapor barrier. Extend the patches 2-inches beyond the break in all directions and secure with adhesive.
4. Seal insulation terminations and pin punctures with a reinforced vapor barrier coating.
5. Continue insulation at fire dampers up to and including those portions of the fire damper frame which are visible at the outside of the rated barrier.
6. Do not conceal duct access doors with insulation.
7. Duct Liners: Install mat finish surface on air stream side. Secure insulation on sheet metal duct with a continuous 100 percent coat of adhesive. For widths over 20-inch, additionally secure the liner with mechanical fasteners 15-inch on center. Cut liner and coat ends with adhesive. Butt joint tightly. Top and bottom sections of insulation overlap sides. Keep duct liner clean and free from dust. If insulation is installed without horizontal, longitudinal and end joints butted together, installation will be rejected.
8. Duct Wrap: Cover supply air ducts except ducts internally lined or where fiberglass ductboard is utilized. Wrap tightly with all circumferential joints butted and longitudinal joints overlapped minimum of 2-inch. Adhere insulation with 4-inch strips of insulating bending adhesive at 8-inch on center. On ducts over 24-inch wide, additionally secure insulation with suitable mechanical fasteners at 18-inch on center. Circumferential and longitudinal joints stapled with flare staples 6-inch on center and covered with 3-inch wide foil reinforced tape.

C. Continue insulation with vapor barrier through penetrations.

D. Internally Lined Ductwork: Where internally lined ductwork is indicated, no exterior insulation is required. Lap the ends of the exterior insulation a minimum of 6 inches past the interior insulation unless otherwise shown. Seal the end of vapor barrier jacket to the duct with mastic where the vapor barrier is required.

3.3 DUCTWORK SURFACES TO BE INSULATED:

<u>Ductwork</u>	<u>Duct Size</u>	<u>Insulation Thickness</u>
Supply and return ductwork (except where duct is lined or where ductboard is utilized)	all	1-1/2" Duct wrap
Supply and return ductwork (exposed to weather and in unheated areas)	all	2" Duct wrap
Outside air ducts	all	2" Duct liner
HVAC plenums	all	2" Duct liner

END OF SECTION

## SECTION 23 3300 - AIR DISTRIBUTION

## PART 1 - GENERAL

## 1.1 WORK INCLUDED:

- A. Provide air distribution equipment as specified herein and shown.
- B. Equipment capacity and size shall be as shown.

## 1.2 QUALITY ASSURANCE:

- A. Ductwork: Comply with requirements of the State Mechanical Specialty Code (latest edition).
- B. Field Wiring: Comply with requirements of Section 23 0000.
- C. Codes: Refer to Section 23 0000.

## 1.3 SUBMITTALS:

- A. Refer to Section 23 0000.
- B. Provide submittals for the following:
  - 1. Spiral ductwork.
  - 2. Flexible ductwork.
  - 3. Dampers.
  - 4. Grilles, Registers and Diffusers.

## 1.4 DELIVERY, STORAGE AND HANDLING:

- A. Deliver product to site under provisions of Section 23 0000.
- B. Store and protect products under provisions of Section 23 0000.
- C. Store all ductwork, materials on pallets or above grade, protected from weather, dirt, mud and other construction dust.
- D. Remove all accumulated dust, dirt, etc. from each duct section as it is being installed.

## PART 2 - PRODUCTS

## 2.1 DUCTWORK:

- A. Galvanized steel sheet metal: Metal gauges, joints and reinforcement in accordance with mechanical Code, ASHRAE and SMACNA tables and recommendations.
- B. Spiral Seam Duct: Round and flat oval spiral seam duct shall be manufactured of galvanized steel sheet metal with spiral lock seam. Matching fittings shall be manufactured of galvanized steel with spot welded seams. United Sheet Metal, Semco, Rolock, Metco or accepted substitute.
- C. Flexible Ductwork: Insulated low pressure flexible duct, factory fabricated assembly consisting of a zinc coated spring steel helix, seamless inner liner, wrapped with a nominal one inch thick, one pound per cubic foot density fiberglass insulation. The assembly shall be sheathed in a vapor barrier jacket, factory sealed at both ends of each section assuring the vapor resistance of each section as well as the completed installation. The composite assembly, including insulation and vapor barrier, shall meet the Class I requirements of NFPA 90A and be labeled by UL with a flame spread rating of 25 or less and a smoke developed rating of 50 or under. The duct shall have factory sealed double air seal (interior and exterior), to assure an airtight installation. Flex duct limited to maximum length of 6'0". Genflex, Wiremold, Thermaflex or accepted substitute.
- D. Metal Round and Flat Oval Spiral Sound-Attenuating Ductwork: duct systems with acoustical attenuation properties equal or greater than those for duct type K27-P by United Sheet Metal. Fittings: Factory fabricated with slip joint construction of the same construction as the duct. Provide 45 degree lateral wye takeoffs. Provide duct sealer for sealing field joints for round spiral lock seam duct systems. United Sheet Metal K-27, Semco, Rolock, Metco or accepted substitute.

## 2.2 DUCT SEALING:

- A. Aluminum bonded to aluminized mylar reinforced with fiberglass mesh backing an elastomeric pressure sensitive adhesive specifically formulated for adhesion to galvanized metal. Hardcast "AFG-1402" with "HD-181" degreaser or accepted substitute.
- B. Two-part sealing system with woven fiber, mineral gypsum impregnated tape and non-flammable adhesive. Hardcast "DT-5300 tape and "RTA-50" adhesive or United "Uni-Cast" system or accepted substitute.
- C. Duct Joints for Sheet Metal Ducts: "Ductmate System" by Ductmate Industries, Inc., for making transverse rectangular and round duct joints. Ward Duct Connectors, Inc., MEZ, Lockformer TDC or accepted substitutes.

### 2.3 ACCESSORIES:

- A. Manual Volume Dampers: Construct of material two gauges heavier than duct in which installed; single plate up to 12 inches wide; multiple over 12 inches wide. Hem both edges 1/2 inch and flange sides 1/2 inch. Provide regulator extension through sheet rock ceiling with concealed adjustable cover. Use Young, DuroDyne or accepted substitute damper accessories.
- B. Opposed Blade Damper: Install opposed blade dampers where shown. Young No. 817 or accepted substitute.

### 2.4 GRILLES, REGISTERS AND DIFFUSERS:

- A. Description: Provide grilles, registers and diffusers as shown.
- B. Finish:
  - 1. Steel: Baked-on white enamel finish, or flat white prime coat, factory applied. Verify the exact finish type with architectural drawings.
  - 2. Aluminum: Clear anodized.
- C. Manufacturers: Air Devices, Anemostat, Carnes, Krueger, Tuttle & Bailey, Price Co., Metalaire are accepted substitutes where Titus model numbers only are listed.

## PART 3 - EXECUTION

### 3.1 LAYOUT AND COORDINATION:

- A. Site Examination: Before starting work, carefully examine site and all contract drawings. Become thoroughly familiar with conditions governing work on this project.
- B. Utility Locations: The location of all utilities, wires, conduits, pipes, ducts, or other service facilities is shown in a general way only on the drawings.

### 3.2 INSTALLATION:

- A. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube opening where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation materials inside a metal ring.
- B. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- C. Provide manual volume dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts for air balancing. Use splitter dampers only where shown. Location of all volume dampers are not necessarily shown on the drawings.

- D. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.
- E. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where shown.
- F. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, and elsewhere as indicated. Provide minimum 12 inches x 12 inches size for hand access, 18 inches x 24 inches size for shoulder access and as indicated. Install necessary access openings and covers for cleaning, wiring or servicing motors, fire dampers, filters, fans, both entering and leaving air sides of coils, and to other equipment located within or blocked by ductwork.
- G. Support: Install ductwork with 1 inch wide 16 gauge cradle hangers not more than 8 feet c/c or as required by code. Support terminal units independent of adjacent ductwork. Attach to available building construction as per good practices for materials involved. Exposed ductwork shall be supported by closed cradle strap suspended from 3/8 inch threaded rod.
- H. Connection Fittings: Round connections to rectangular ducts manufactured sheet metal "spin-in" fittings. Genflex, Wiremold, Thermaflex, Glassflex, Clevepak, Manville, or accepted substitute.
- I. Elbows and Fittings: Construct elbows with throat radius equal to duct width in plane or turn or make them square and provide double wall, air foil turning vanes.
- J. Fittings: Make transitions and take-offs as shown. Provide volume dampers and splitter dampers as shown and as specified.
- K. Sleeves: Provide galvanized sheet metal plaster ring around ductwork penetrating exposed finished walls. Sleeve and flash all duct penetrations through exterior walls in an airtight and weatherproof manner.
- L. Manual Volume Dampers: Location of all volume dampers are not necessarily shown. Provide a minimum of one volume damper in each supply, return or exhaust branch.
- M. Duct Insulation: Insulate all ductwork per Section 23 0700 as requiring insulation. In addition, all ductwork indicated in Table No. 13-S of the Structural Specialty Code and Fire and Life Safety Regulations shall be insulated or lined.
- N. Flexible Ductwork: Support hanger or saddle material in contact with duct shall be of sufficient width to prevent any restriction of the internal diameter of the duct, and in no case less than 1 inch wide. Maximum sag to be 1/2 inch per foot of spacing between supports. Flexible ducts shall be installed in a fully extended condition free of kinks with no direction change to exceed 90 degrees, using only the minimum length required to make the connection with a maximum length of 24 inches. Sheet metal collars to which the duct is attached shall be a minimum of 2 inches long. Flexible duct shall be inserted into the collar a minimum of 1 inch and inner liner secured with a minimum 1/2 inch wide positive locking steel strap. In ducts larger than 12 inches diameter, steel strap must be secured by beading. Reshape insulation and vapor barrier over duct and collar and secure using drawband. Attachment of joints is similar using a minimum of 4 inches long collar.

- O. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.3 ADJUSTING AND CLEANING:

- A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

END OF SECTION

## SECTION 23 3450 – DUST COLLECTOR

## PART 1 - GENERAL

## 1.1 WORK INCLUDED:

- A. Provide dust collector and associated materials as specified herein and shown on the Drawings.

## 1.2 SUBMITTALS:

- A. Refer to Section 23 0000.
- B. Provide Submittals for all fans scheduled.
- C. Submit sound power levels for fans.

## PART 2 - PRODUCTS

## 2.1 DUST COLLECTOR:

- A. Standard finish coat
- B. Filter media: 8oz. woven polyester
- C. Roof assembly: Weather bend roof
- D. Hopper/Leg pack: with 55-gallon drum cover w/ latches
- E. Explosion vent
- F. Fans and motors: 5 HP K7 fan w/ TEFC 208/230/460/575/60/3
- G. Shaker drive assembly motor: 1/3 HP 208/230/460/60/3 TEFC
- H. Controller: NEMA 4/12 remote push button with running light
- I. Accessories: Sound dampened fan chamber
- J. Accessories: Magnehelic gauge

## 2.2 MANUFACTURERS:

- A. Donaldson Torit

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install to manufacturer recommendations.

END OF SECTION

DIVISION 26 SPECIFICATIONS

SECTION 26 0000	ELECTRICAL GENERAL REQUIREMENTS
SECTION 26 0519	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
SECTION 26 0526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
SECTION 26 0529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
SECTION 26 0533	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
SECTION 26 0553	IDENTIFICATION FOR ELECTRICAL SYSTEMS
SECTION 26 2726	WIRING DEVICES
SECTION 26 2800	LOW-VOLTAGE CIRCUIT PROTECTIVE DEVICES
SECTION 26 0923	LIGHTING CONTROL DEVICES
SECTION 26 5000	LIGHTING

## SECTION 26 0000 - ELECTRICAL GENERAL REQUIREMENTS

## PART 1 - GENERAL

## 1.1 RELATED DIVISIONS SUMMARY:

## A. Section Includes:

1. Electrical systems required for this work includes labor, materials, equipment, and services necessary to complete installation of electrical work for one Tenant improvement as shown on Drawings, specified herein or required for a complete operable facility and not specifically described in other Sections of these Specifications. Among the items required are:
  - a. Feeders to switchboards, distribution panels, HVAC equipment, Owner provided equipment and other equipment as detailed.
  - b. Branch circuit wiring from the distribution panels for lighting, receptacles, motors, signal systems and other detailed circuit wiring.
  - c. Luminaires, control switches, receptacles, relays, supports and other accessory items.
  - d. Wiring and power connections for motors installed for heating, cooling and ventilation.
  - e. Other systems as noted on drawings and in these specifications.

## 1.2 DEFINITIONS:

## A. Following is a list of abbreviations generally used in Divisions 26:

1. AHJ Authority Having Jurisdiction.
2. ADA Americans With Disabilities Act.
3. ANSI American National Standards Institute.
4. APWA American Public Works Association.
5. ASTM American Society for Testing and Materials.
6. FCC Federal Communications Commission.
7. HVAC Heating-Ventilating and Air Conditioning.
8. IBC International Building Code.
9. IEEE Institute of Electrical and Electronic Engineers.
10. IEC International Electrotechnical Commission.
11. IETA International Electrical Testing Association.
12. IFC International Fire Code.
13. FM Factory Mutual.
14. NEMA National Electrical Manufacturer's Association
15. NFPA National Fire Protection Association.
16. NEC National Electric Code.
17. OSHA Occupational Safety and Health Administration.
18. UL Underwriters' Laboratories, Inc.

- B. Provide: To furnish and install, complete and ready for the intended use.
- C. Furnish: Supply and deliver to the project site, ready for unpacking, assembly and installation.
- D. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at the project site as required to complete items of work furnished by others.

### 1.3 ADDITIONAL REQUIREMENTS TO DIVISION 01:

- A. Operation and Maintenance Documentation: Provide copies of certificates of code authority acceptance, test data, product data, guarantees, warranties, and the like.
- B. Shop Drawings: When requested by individual Sections provide shop drawings, which include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and the like. Refer to individual Specification Sections for additional requirements for the shop drawings.
- C. Closeout Documentation: Submit electrical code authority certification of inspection. Include documentation of on-site electrical testing that was performed.
  - 1. Training: Provide training for appropriate District personnel. Training will review complete Operations and Maintenance (O&M) Manual, including but not limited to, programming and setup of any control systems, required maintenance, and troubleshooting, including contact names and phone numbers for factory support.
- D. Record Drawings:
  - 1. Show changes and deviations from the Drawings. Include written Addendum and change order items.
  - 2. Show exact routes of feeders 60 amp and larger, conduits for signal systems 2-inches in diameter and larger, and service entrance conduits.
  - 3. Show exact location of switchboards, distribution panelboards, safety disconnects, motor controllers, and the like.
  - 4. Make changes to Drawings in a neat, clean, and legible manner.
  - 5. Provide an 11 x 17 size Record Drawing of the one-line power diagram sealed in a plastic coating. Mount on the wall of the electric room.

### 1.4 QUALITY ASSURANCE:

- A. Conform to requirements of the NEC, latest adopted version with amendments by local AHJs.
- B. Conform to latest adopted version of the IBC with Oregon amendments.
- C. Obtain and pay for electrical permits, plan review, and inspections.
- D. Furnish products listed by UL or another testing firm acceptable to AHJ.
- E. Conform to requirements of the serving electric, and telephone utilities.

## 1.5 SEQUENCING AND SCHEDULING:

- A. For the proper execution of the work cooperate with other crafts and contracts as needed.
- B. To avoid installation conflicts, thoroughly examine the complete set of Contract Documents. Resolve conflicts with Architect prior to installation.
- C. Prior to installation of feeders to equipment requiring electrical connections, examine the manufacturer's shop drawings, wiring diagrams, product data, and installation instructions. Verify that the electrical characteristics detailed in the Contract Documents are consistent with the electrical characteristics of the actual equipment being installed. When inconsistencies occur request clarification from Architect.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS:

- A. Provide like items from one manufacturer, such as, luminaire types, switches, receptacles, breakers, panels, and the like.

## 2.2 MATERIALS:

- A. Provide new electrical materials of the type and quality detailed, listed by UL, bearing their label wherever standards have been established. Indicated brand names and catalog numbers are used to establish standards of performance and quality. The description of materials listed herein governs in the event that catalog numbers do not correspond to materials described herein.
- B. Provide material and equipment that is acceptable to AHJ as suitable for the use indicated. For example, provide wet labeled equipment in locations that are wet.
- C. Include special features, finishes, accessories, and other requirements as described in the Contract Documents regardless of the item's listed catalog number.
- D. Provide incidentals not specifically mentioned herein or noted on Drawings, but needed to complete the system or systems, in a safe and satisfactory working condition.

## 2.3 FIRESTOPPING:

- A. Foam Sealant: Foam sealant for use around conduit penetrations to prevent passage of smoke, fire, toxic gas or water. Maintain seal before, during and after fire. In and around conduit for thermal break at penetration of barrier between heated and unheated spaces. Chase Technology Corporation, Fire Foam, Thomas & Betts, or approved.

## PART 3 - EXECUTION

## 3.1 EXAMINATION:

## A. Construction Documents:

1. Drawings are diagrammatic with symbols representing electrical equipment, outlets, luminaires, and wiring.
2. Electrical symbols indicating wiring and equipment shown in the Contract Documents are included in the Contract unless specifically noted otherwise.
3. Examine the entire set of Drawings to avoid conflicts with other systems. Determine exact route and installation of electrical wiring and equipment with conditions of construction.

## B. Clarification:

1. The Drawings govern in matters of quantity, the Specification in matters of quality. In event of conflict on Drawings or in the Specifications, the greater quantity and the higher quality apply.
2. Should the Electrical Documents indicate a condition conflicting with the governing codes and regulations, refrain from installing that portion of the work until clarified by Architect.

## 3.2 INSTALLATION:

## A. Install electrical equipment complete as directed by manufacturer's installation instructions.

Obtain installation instructions from manufacturer prior to rough-in of the electrical equipment, examine the instructions thoroughly. When requirements of the installation instructions conflict with the Contract Documents, request clarification from Architect prior to proceeding with the installation.

## B. Do not install electrical equipment in obvious passages, doorways, scuttles or crawl spaces which would impede or block the area passage's intended usage.

## C. Noise Control:

1. Do not install outlet boxes back to back. Do not use straight through boxes.
2. Do not place contactors, transformers, starters and similar noise producing devices on walls, which are common to occupied spaces, unless specifically called for on Drawings. Where such devices must be mounted on walls common to occupied spaces, mount or isolate in such a manner as to effectively prevent the transmission of their inherent noise to the occupied space.

## D. Firestopping:

1. Coordinate with the Drawings the location of fire rated walls, ceilings, floors and the like. When these assemblies are penetrated by electrical equipment, seal around the equipment with approved firestopping material. Maintain integrity of rated assemblies

2. Install firestopping material complete as directed the manufacturer's installation instructions.

### 3.3 FIELD QUALITY CONTROL:

#### A. Tests:

1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified in Divisions 26, 27, and 28. Refer to individual Specification Sections for required tests. Document tests and include in Closeout Documents.
2. During site evaluations, by Architect or Engineer, provide an electrician with tools to remove and replace trims, covers, devices, and the like, so that a proper evaluation of the installation can be performed.

### 3.4 CLEANING:

- A. Remove dirt and debris caused by the execution of the electrical work.
- B. Leave the entire electrical system installed under this Contract in clean, dust-free and proper working order.
- C. Vacuum clean interiors of electrical equipment enclosures.

END OF SECTION

## SECTION 26 0519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

## PART 1 - GENERAL

## 1.1 SUMMARY:

- A. Wires and cables.
- B. Connectors.
- C. Lugs and pads.
- D. MC cable.

## 1.2 SYSTEM DESCRIPTION:

- A. Provide wires, cables, connectors, lugs, and the like for a complete and operational electrical system.

## 1.3 SUBMITTALS:

- A. Provide product data for the following equipment:
  - 1. Wires.
  - 2. Cables.
  - 3. Connectors.
  - 4. Lugs.
- B. Provide the insulation cable testing report in the project closeout documentation, see Project Closeout Requirements in Division 01.

## 1.4 REGULATORY REQUIREMENTS:

- A. Conform to requirements of the NEC, latest adopted version with amendments by local AHJs.
- B. Furnish products listed by UL or another testing firm acceptable to AHJ.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS:

- A. Wires and Cables: Carol, General Cable, Okonite, Rome, Southwire, or approved.

- B. Connectors: Stranded conductors by Anderson, Burndy, IlSCO, Thomas & Betts, or approved.
- C. Splices:
  1. Branch Circuit Splices: Ideal, Scotch-Lock, 3M, or approved.
  2. Feeder Splices: Compression barrel splice with two layers Scotch 23 and four layers of Scotch 33+ as vapor barrier.
- D. MC Cable: Alflex, AFC, Carol, or approved.

## 2.2 WIRES AND CABLES:

- A. Copper, 600 volts rated throughout. Conductors 14AWG to 10AWG, stranded. Conductors 8AWG and larger, stranded.
- B. Phase color to be consistent at all feeder terminations; A-B-C, top to bottom, left to right, front to back.
- C. Color Code Conductors as Follows:
 

PHASE	208 VOLT WYE
A	Black
B	Red
C	Blue
Neutral	White
Ground	Green
Isolated Ground	Green w/yellow trace
- D. Conductors 3AWG and larger, minimum insulation rating of 75C.
- E. Insulation types THWN, THHN or XHHW-2. Minimum insulation rating, 90C, for branch circuits.
- F. MC Cable: High strength galvanized steel or aluminum flexible armor. Full length minimum size No. 12 copper ground wire, THHN 90C conductors, full length tape marker. Overall PVC or nylon cable tape. Short circuit throat insulators, mechanical compression termination. Manufacturers: Alflex, AFC, or Carol.

## 2.3 CONNECTORS:

- A. Copper Pads: Drilled and tapped for multiple conductor terminals.
- B. Lugs: Indent/compression type for use with stranded branch circuit or control conductors.
- C. Solid Conductor Branch Circuits: Spring connectors, wire nuts, for conductors 18 through 8AWG.

## 2.4 LUGS AND PADS:

- A. Ampacity: Cross-sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.

## PART 3 - EXECUTION

## 3.1 INSTALLATION:

## A. Wires and Cables:

1. Conductor Installation:
  - a. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.
  - b. Install conductors with care to avoid damage to insulation.
  - c. Do not apply greater tension on conductors than recommended by manufacturer during installation.
  - d. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation.
2. Conductor Size and Quantity:
  - a. Install no conductors smaller than 12AWG unless otherwise shown.
  - b. Provide all required conductors for a fully operable system.
3. Provide dedicated neutrals (one neutral conductor for each phase conductor) in the following single phase circuits:
  - a. Dimmer controlled circuits.
  - b. Isolated ground circuits.
  - c. Ground fault protected circuits where a GFI breaker is used in a panelboard.
  - d. Other electronic equipment which producer a high level of harmonic distortion including but not limited to computers, printers, plotters, copy machines, fax machines, and the like.
4. MC cable allowed in the following locations only: For single branch circuit extension within the room when originated from j-box with home run wiring in conduit.
5. Conductors in Cabinets:
  - a. Cable and tree all wires in panels and cabinets for power and control. Use plastic ties in panels and cabinets.
  - b. Tie and bundle feeder conductors in wireways of panelboards.
  - c. Hold conductors away from sharp metal edges.
6. Connectors: Retighten mechanical type lugs and connectors for conductors to equipment prior to Substantial Completion.

### 3.2 FIELD QUALITY CONTROL:

#### A. Tests:

1. Test conductor insulation on feeders of 100 amp and greater for conformity with 1000 volt megohmmeter. Use Insulated Cable Engineers Association testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below. In the condition that the insulation resistance is less than 1 megohm notify Architect.
2. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance of the megohmmeter test. Submit report with operating and maintenance manual.

END OF SECTION

## SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.1 SUMMARY:

- A. Grounding materials.
- B. Electric service grounding electrode.
- C. Feeder and branch circuit grounding.
- D. Raceway and enclosure grounding.
- E. Equipment grounding.
- F. Receptacle grounding.
- G. Related Sections:
  - 1. Section 26 0519, Low-Voltage Electrical Power Conductors and Cables.
  - 2. Section 26 0533, Raceway and Boxes for Electrical Systems.

## 1.2 SYSTEM DESCRIPTION:

- A. Provide grounding and bonding of electrical service, circuits, equipment, signal and communications systems.
- B. Performance Requirements: Supplement the grounded neutral of the secondary distribution system with an equipment grounding system to properly safeguard the equipment and personnel. Install equipment grounding such that all metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, portable equipment and other conductive items in close proximity with electrical circuits operate continuously at ground potential and provide a low impedance path for possible ground fault currents.

## 1.3 SUBMITTALS:

- A. Provide Shop drawings and product data for the grounding material.
- B. Provide the following test reports for information:
  - 1. Grounding system test.

## 1.4 REGULATORY REQUIREMENTS:

- A. Conform to requirements of the NEC, latest adopted version with amendments by local AHJs.
- B. Furnish products listed by UL or another testing firm acceptable to AHJ.

## PART 2 - PRODUCTS

## 2.1 MATERIALS:

- A. Ground Rods: Copperclad steel, 3/4-inch diameter, 10-feet long, tapered point, chamfered top. Manufacturers: Weaver, Thomas & Betts, Talley, or approved.
- B. Grounding Connectors: Hydraulic compression tool applied connectors or exothermic welding process connectors or powder actuated compression tool applied connectors. Mechanical connectors are not acceptable. Manufacturers: Burndy Hyground Compression System, Erico/Cadweld, Amp Ampact Grounding System or approved.
- C. Pipe Grounding Clamp: Mechanical ground connector with cable parallel or perpendicular to pipe. Burndy GAR Series, O-Z Gedney, Thomas & Betts or approved.
- D. Telecommunications Grounding Bar: 1/4-inch thick by 4-inch high by 20-inch long copper ground bar with insulators. Manufacturers: Erico/Cadweld or approved.
  - 1. Grounding Electrode Conductor: Bare copper stranded conductor.

## PART 3 - EXECUTION

## 3.1 INSTALLATION:

- A. Ground Rod Electrode:
  - 1. Arrange conductor to provide maximum exposure to earth in the perimeter footing. Do not fold conductor.
  - 2. Bond grounding electrode conductor to driven ground rods at 10-foot intervals.
  - 3. Tap at center ground rod and extend ground electrode conductor to service ground bus. Install ground electrode conductor extension in rigid PVC conduit for physical protection.
- B. Water Service Grounding: Bond building ground electrode and water service pipe to service ground bus. Connect to water pipe on utility side of isolating fittings or meters, bond across water meters.
- C. Raceways:
  - 1. Ground all metallic raceway systems. Bond to ground terminal with code size jumper except where code size or larger grounding conductor is included with circuit, use grounding bushing with lay-in lug.

2. Connect all metal raceways, which terminate within an enclosure but without mechanical connection to the enclosure, by grounding bushings and ground wire to the grounding bus.
  3. Where equipment supply conductors are in flexible metallic conduit, install stranded copper equipment grounding conductor from outlet box to equipment frame.
  4. Install equipment grounding conductor, code size minimum unless noted on Drawings, in all nonmetallic and metallic raceway systems.
- D. Feeders and Branch Conduits:
1. Install continuous insulated equipment copper ground conductors within the following circuits: feeders, circuits for computer systems and other circuits as indicated on Drawings.
  2. Where installed in a continuous solid metallic raceway system and larger sizes are not detailed, provide insulated equipment ground conductors for feeders and branch circuits sized in accordance with Table 250.122.
- E. Boxes, Cabinets, Enclosures and Panelboards:
1. Bond grounding conductors to enclosure with specified conductors and lugs. Install lugs only on thoroughly cleaned contact surfaces.
  2. Bond all sections of service equipment enclosure to service ground bus.
- F. Motors, Equipment and Appliances: Install code size equipment grounding conductor from outlet box to (motor) equipment frame or manufacturer's designated ground terminal.
- G. Receptacles: Connect ground terminal of receptacle to equipment ground system by No. 12 conductor bolted to outlet box except isolated grounds where noted. Self-grounding nature of receptacle devices does not eliminate the requirement for ground conductor bolted to outlet box.
- H. Telecommunications Backboard: Provide telecommunications ground bar at each telecommunications backboard. Bond the grounding bar to service grounding bar in the main service equipment with a 6AWG copper equipment ground conductor.
- I. Separately Derived Systems: Ground each separately derived system per NEC 250.30.

END OF SECTION

## SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.1 SYSTEM DESCRIPTION:

- A. Safety factor of 4 required for every fastening device or support for electrical equipment installed. Support to withstand four times weight of equipment it supports.

## 1.2 SUPPORTING DEVICES:

- A. Safety factor of 4 required for every fastening device or support for electrical equipment installed. Support to withstand four times weight of equipment it supports. Bracing to comply with Seismic Zone 3 requirements.

## PART 2 - PRODUCTS

## 2.1 MATERIALS:

- A. Hangers: Kindorf B-905-2A channel, H-119-D washer, C105 strap, 3/8-inch rod with ceiling flange.
- B. Concrete Inserts: Kindorf D-255, cast in concrete for support fasteners for loads up to 800 lbs.
- C. Pipe Straps: Two-hole galvanized or malleable iron.
- D. Luminaire Chain: Campbell Chain 75031, 90-lb. test with steel hooks.

## PART 3 - EXECUTION

## 3.1 INSTALLATION:

- A. Provide all electrical equipment supports.
- B. Verify mounting height of all luminaires or items prior to installation when heights are not detailed.
- C. Install vertical support members for equipment and luminaires, straight and parallel to building walls.
- D. Provide independent supports to structural member for electrical luminaires, materials, or equipment installed in or on ceiling, walls or in void spaces or over furred or suspended ceilings.

- E. Do not use other trade's fastening devices as supporting means for electrical equipment materials or fixtures.
- F. Do not use supports or fastening devices to support other than one particular item.
- G. Support conduits within 18-inches of outlets, boxes, panels, cabinets and deflections.
- H. Maximum distance between supports not to exceed 8-foot spacing.
- I. Securely suspend all junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from the floor above or roof structure to prevent sagging and swaying.
- J. Provide seismic bracing per IBC requirements.

END OF SECTION

## SECTION 26 0533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.1 SUMMARY:

## A. Section Includes:

1. Raceways.
2. Conduit fittings.
3. Sleeves and chases.
4. Surface metal raceways.
5. Outlet boxes.
6. Weatherproof outlet boxes.
7. Junction and pull boxes.
8. Floor boxes.

## 1.2 SYSTEM DESCRIPTION:

## A. Raceways:

1. Provide raceways, wires, cables, connector, boxes, devices, finish plates and the like for a complete and operational electrical system.
2. Electrical Connections: Connect equipment, whether furnished by Owner or other Divisions of the Contract, electrically complete.
3. Supporting Devices: Safety factor of 4 required for every fastening device or support for electrical equipment installed. Support to withstand four times weight of equipment it supports. Bracing to comply with Seismic Zone 3 requirements.

## B. Boxes:

1. Outlet System: Provide electrical boxes and fittings as required for a complete installation. Include but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts, and all other necessary components.
2. Code Compliance: Comply with NEC as applicable to construction and installation of electrical boxes and fittings and size boxes according to NEC 370, except as noted otherwise.
3. Flush Outlets in Insulated Spaces: Maintain integrity of insulation and vapor barrier.

## 1.3 SUBMITTALS:

## A. Provide Shop Drawings and Product Data for the Following Equipment:

1. Raceways.
2. Conduit fittings.
3. Surface metal raceways.

4. Outlet boxes.
5. Weatherproof outlet boxes.
6. Junction and pull boxes.
7. Floor boxes.

#### 1.4 REGULATORY REQUIREMENTS:

- A. Conform to requirements of the NEC, latest adopted version with amendments by local AHJs.
- B. Furnish products listed by UL or another testing firm acceptable to AHJ.

#### 1.5 SEQUENCING AND SCHEDULING:

- A. Raceway System is Defined as Consisting of: Conduit, tubing or duct and fittings including but not limited to connectors, couplings, offsets, elbows, bushings, expansion and deflection fittings and other components and accessories. Complete electrical raceway installation before starting the installation of conductors and cables.
- B. Finished Surfaces: Prevent cutting in connection with finished work. Make repairs in a manner approved by Architect.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS:

- A. Raceways: Allied Steel, Certainteed, Jones & Laughlin, Carlon, Kraloy, or approved.
- B. Conduit Fittings: 0-Z Gedney, Thomas & Betts, Crouse & Hinds, or approved.
- C. Surface Metal Raceway System: Square D, Wiremold, or approved, unless specifically noted on Drawings.
- D. Outlet Boxes: Bowers, Raco, or approved.
- E. Weatherproof Outlet Boxes: Bell, Red Dot, Carlon, or approved.
- F. Junction and Pull Boxes: Circle AW, Hoffman, or approved.
- G. Box Extension Adapter: Bell, Red Dot, Carlon, or approved.
- H. Conduit Fittings: O-Z Gedney, Thomas & Betts, or approved.
- I. Floor Boxes: Wiremold/Walker, Hubbell, Steel City, or approved.

## 2.2 CONDUITS:

- A. Galvanized Rigid Steel Conduit: (GRC)
  - 1. Hot-dip galvanized after thread cutting.
  - 2. Manufacture in conformance with Federal Specification WWC-581 and ANSI C80.1.
  - 3. Uniform finish coat with chromate for added protection.
- B. Intermediate Metal Conduit: (IMC)
  - 1. Hot-dip galvanized after thread cutting.
  - 2. Manufacture in conformance with Federal Specification WWC-581.
  - 3. Uniform finish coat with chromate for added protection.
- C. Electrical Metallic Tubing: (EMT)
  - 1. Hot-dip galvanized and chromate coated.
  - 2. Manufacture in conformance with Federal Specification WWC-563 and ANSI C80.3.
- D. Flexible Conduit:
  - 1. Reduced wall flexible steel conduit.
  - 2. Hot-dip galvanize steel strip prior to forming and joining.
  - 3. Manufacture in conformance with Federal Specification WWC-566.
- E. Flexible Conduit, PVC Coated:
  - 1. Hot-dip galvanize steel strip prior to forming and joining.
  - 2. PVC chemical resistant jacket extruded to core, up to 1-inch trade size.
  - 3. PVC chemical resistant jacket tubed over core, up to 4-inch trade size.
- F. PVC:
  - 1. Class 40 heavy wall rigid PVC.
  - 2. Rated for use with 90C conductors.
  - 3. Manufacture in conformance with Federal Specification WC1094A and NEMA TC-2.

## 2.3 CONDUIT FITTINGS:

- A. Bushings:
  - 1. Insulated Type for Threaded Rigid, IMC Conduit or Raceway Connectors without Factory Installed Plastic Throat Conductor Protection: Thomas & Betts 1222 Series or O-Z Gedney B Series.
  - 2. Insulated Grounding Type for Threaded Rigid, IMC Conduit and Conduit Connectors: O-Z Gedney BLG Series.
- B. Raceway Connectors and EMT Couplings:
  - 1. Steel conductor and coupling bodies, with zinc electroplate or hot-dip galvanizing.

2. Connector locknuts are steel, with threading meeting ASTM tolerances. Locknuts are zinc electroplated or hot-dip galvanized.
3. Connector throats (EMT, flexible conduit, metal clad cable and cord set connectors) have factory installed plastic inserts permanently installed. For normal cable or conductor exiting angles from the raceway (NEC bending radius), the cable jacket or conductor insulation bears only on the plastic throat insert.
4. Steel gland, Tomic or Breagle connectors and couplings are recognized for this Contract as having acceptable raceway to fitting electrical conductance.
5. Set screw connectors and couplings, without integral compression glands, are recognized for this Contract as not having acceptable raceway to fitting electrical conductance. A ground conductor sized per this Specification must be included and bonded within a raceway assembly utilizing this type connector or coupling.

C. Expansion/Deflection Fittings:

1. EMT, O-Z Gedney Type TX.
2. RMC, O-Z Gedney Type AX, DX and AXDX, Crouse & Hinds XD.

2.4 BOXES:

A. Outlet Boxes:

1. Luminaire Outlet: 4-inch octagonal box, 1-1/2-inches deep with 3/8-inch luminaire stud if required. Provide raised covers on bracket outlets and on ceiling outlets.
2. Device Outlet: Installation of one or two devices at common location, minimum 4-inch square, minimum 1-1/2-inches deep. Single or 2-gang flush device raised covers. Raco Series 681 and 686.
3. Multiple Devices: Three or more devices at common location. Install 1-piece gang boxes with 1-piece device cover. Install one device per gang.
4. Masonry Boxes: Outlets in concrete, Raco Series 690.
5. Construction: Provide galvanized steel interior outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices.
6. Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

B. Weatherproof Outlet Boxes:

1. Construction: Provide corrosion-resistant cast metal weatherproof outlet wiring boxes, of the type, shape and size, including depth of box, with threaded conduit ends, cast metal face plate with spring-hinged waterproof cap suitably configured for each application, including face plate gasket, blank plugs and corrosion proof fasteners. Weatherproof boxes to be constructed to have smooth sides, gray finish.

## 2.5 JUNCTION AND PULL BOXES:

- A. Construction: Provide galvanized sheet steel junction and pull boxes, with screw-on covers; of the type shape and size, to suit each respective location and installation; with welded seams and equipped with steel nuts, bolts, screws and washers.
- B. Install junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
- C. Install junction boxes and pull boxes as required to facilitate the installation of conductors and limiting the accumulated angular sum of bends between boxes, cabinets and appliances to 270 degrees.
- D. All pull boxes, junction boxes, and other enclosures shall be accessible without conflict from other equipment or trades. Pull boxes and junction boxes shall be installed where required to facilitate wire installation.
- E. All switch, pull, junction boxes, and other enclosures shall be hot dipped galvanized, concrete tight, with interlocking ring.
- F. Avoid proximity to heat ducts and/or steam lines. All conduits shall clear ducts or lines and their coverings by a minimum of 6":
  - 1. Interior Outlet:
    - a. One-piece boxes and one-piece device covers are required
    - b. Minimum box sizes: Galvanized steel, 4" square, 1½" deep
    - c. Signal system outlets' minimum box size: 4" square, 2⅛" deep

## 2.6 BOX EXTENSION ADAPTER:

- A. Construction: Diecast aluminum.
- B. Location: Install over flush wall outlet boxes to permit flexible raceway extension from flush outlet to fixed or movable equipment. Bell 940 Series, Red Dot IHE4 Series.

## 2.7 CONDUIT FITTINGS:

- A. Requirements: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and plastic conduit bushings of the type and size to suit each respective use and installation.
- B. Activations:
  - 1. Flush: Provide brass duplex or single signal cover, hinged with set screw lock. Carpet or tile finish ring.
  - 2. Monuments: Not allowed.
  - 3. Coordinate specific application of systems as noted on Drawings.
- C. Plastic floor boxes will not be considered.

- D. Location: Concrete floor. Use poke-thru of same construction in non-concrete structure. Verify exact locations. Ensure flush with finish surface.

### PART 3 - EXECUTION

#### 3.1 PREPARATION:

- A. Inserts, Anchors and Sleeves.
- B. Coordinate location of inserts and anchor bolts for electrical systems prior to pouring concrete.
- C. Coordinate location of sleeves for electrical systems prior to pouring concrete, with consideration for all other building systems.

#### 3.2 INSTALLATION:

- A. Conduits: All conduits shall be installed in a concealed manner where possible and shall be installed parallel to the lines of the building. All conduits shall be a minimum of  $\frac{3}{4}$ ". Any exposed conduits shall be installed parallel or at right angles to the building walls or floors. All exposed conduits shall be securely fastened in place on maximum 5'-0" intervals for  $\frac{3}{4}$ " through 2  $\frac{1}{2}$ " nominal sizes.
  - 1. Runs between junction boxes shall not contain more than the equivalent of three 90° bends. (No more than 270° total in bends.) Conduit bends shall be made with appropriate tools of proper size; radius of bends shall be at least six times the diameter of the conduit.
- B. Conduit Joints: Assemble conduits continuous and secure to boxes, panels, luminaires and equipment with fittings to maintain continuity. Provide watertight joints where embedded in concrete, below grade or in damp locations. Seal PVC conduit joints with solvent cement and metal conduit with metal thread primer. All rigid conduit connections to be threaded, clean and tight (metal to metal). Threadless connections are not permitted for GRC and IMC.
  - 1. Conduit Placement
  - 2. Install continuous conduit and raceways for electrical power wiring and signal systems wiring. Power and signal systems to be installed in separate conduits unless otherwise noted on Drawings.
  - 3. Conceal all conduits. Exposed conduits are permitted only in the following areas:
    - a. Mechanical rooms, electrical rooms or spaces where walls, ceilings and floors will not be covered with finished materials.
    - b. Existing walls that are concrete or block construction.
    - c. Where specifically noted on the Drawings.
    - d. Where exposed conduits are permitted install parallel or at right angles to building lines, tight to finished surfaces and neatly offset into boxes.
    - e. Do not install conduits or other electrical equipment in obvious passages, doorways, scuttles or crawl spaces which would impede or block the area passage's intended usage.

- f. Do not install conduits on surface of building exterior, across roof, on top of parapet walls, or across floors.
  4. Maximum Bends: Install code sized pull boxes to restrict maximum bends in a run of conduit to 270 degrees.
  5. Conduit Terminations: Provide conduits shown on Drawings which terminate without box, panel, cabinet or conduit fitting with not less than five full threads. Bushings and metal washer type sealer between bushing and conduit end.
  6. Flexible Conduit: Install 12-inch minimum slack loop on flexible metallic conduit and PVC coated flexible metallic conduit.
  7. Conduit Size: Size as indicated on Drawings. Where size is not indicated, provide conduit in minimum code permitted size for THW conductors of quantity shown. Minimum trade size 1/2-inch.
- C. Conduit Use Locations:
1. Cast-in-Place Concrete, Masonry, Damp Locations and Subject to Mechanical Damage: GRC or IMC.
  2. Dry, Protected: GRC, IMC, EMT.
  3. Sharp Bends and Elbows: GRC, EMT use factory elbows.
- D. Install pull wire or nylon cord in empty raceways provided for other systems. Secure wire or cord at each end.
- E. Elbows for Signal Cables: Use long radius factory ells where linking sections of raceway for installation of signal cable.
- F. Motors, recessed luminaires and equipment connections subject to movement or vibration, use flexible metallic conduit.
- G. Motors and equipment connections subject to movement or vibration and subjected to any of the following conditions: exterior location, moist or humid atmosphere, water spray, oil or grease use PVC coated liquid tight flexible metallic conduit.
- H. Branch Circuits: Do not change the intent of the branch circuit or controls without approval. Homeruns for 20 amp branch circuits may be combined to a maximum of six conductors in a homerun. Apply derating factors as required by NEC 310. Increase conductor size as needed.
- I. Feeders: Do not combine or change feeder runs.
- J. Unless otherwise indicated, provide raceway systems for lighting, power and Class 1 remote-control and signaling circuits and Class 2 and 3 remote-control signaling and communication circuits.
- K. Condulets and Conduit Bodies: Condulets and conduit bodies are not allowed.
- L. Sleeves and Chases - Floor, Ceiling and Wall Penetrations: Provide necessary rigid conduit sleeves, openings and chases where conduits or cables are required to pass through floors, ceiling or walls.

## M. Boxes:

1. Location: Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.
2. Round Boxes: Avoid using round boxes where conduit must enter through side of box, which would result in a difficult and insecure connection with a locknut or bushing on the rounded surface.
3. Anchoring: Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.
4. Special Application: Provide weatherproof outlets for locations exposed to weather or moisture.
5. Knockout Closures: Provide knockout closures to cap unused knockout holes where blanks have been removed.
6. Mount Center of Outlet Boxes, unless Otherwise Required by ADA, or Noted on Drawings, the Following Distances above the Floor:
  - a. Control Switches: 48-inches.
  - b. Receptacles: 18-inches.
  - c. Telecom Outlets: 18-inches.
  - d. Other Outlets: As indicated in other Sections of Specifications or as detailed on Drawings.
7. Coordinate all electrical device locations (switches, receptacles, and the like) with Drawings to prevent mounting devices in mirrors, back splashes, behind cabinets, and the like.

END OF SECTION

## SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.1 SUMMARY:

- A. Section Includes:
  - 1. Equipment identification labels.
  - 2. Conductor identification numbers.
  - 3. Branch circuit schedules.
  - 4. Circuit breaker identification.
  - 5. Receptacles and switches identification.
  - 6. Junction and pull box identification.

## 1.2 SYSTEM DESCRIPTION:

- A. Design Requirements
- B. Coordinate names, abbreviations and other designations with equipment specified in this or other Divisions of the Specification or identified on Drawings.
- C. Fasten labels to equipment in a secure and permanent manner.

## 1.3 REGULATORY REQUIREMENTS:

- A. Conform to requirements of the NEC, latest adopted version with amendments by local AHJs.
- B. Furnish products listed by UL or another testing firm acceptable to AHJ.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS:

- A. Engraved Labels: Lamicoid or approved.
- B. Conductor Numbers: Brady or approved.

## 2.2 ENGRAVED LABELS:

- A. Melamine plastic laminate, white with black core, 1/16-inch thick.

- B. Letter and number font: Engravers standard letter style, minimum 3/16-inch high letters, all capitals.
- C. Drill or punch labels for mechanical fastening except where adhesive mounting is necessary because of substrate. Use self-tapping stainless steel screws.
- D. Dymo tape labels are not acceptable.

### 2.3 CONDUCTOR NUMBERS:

- A. Cable and conductor markers: Standard vinyl-cloth self-adhesive backing, wraparound type. Pre-printed black numbers on a yellow field.

### 2.4 BRANCH CIRCUIT SCHEDULES:

- A. Provide branch circuit identification schedules, typewritten, clearly filled out, to identify load connected to each circuit and location of load. Numbers to correspond to numbers assigned to each circuit breaker pole position.
- B. Provide two columns, odd numbers in left column, even numbers in right column, with 3-inch wide line for typing connected load information.

### 2.5 CIRCUIT BREAKER IDENTIFICATION:

- A. Provide permanent identification number in or on panelboard dead-front adjacent to each circuit breaker pole position. Square D adhesive approved, other adhesives by specific prior approval only.
- B. Horizontal centerline of engraved numbers to correspond with centerline of circuit breaker pole position.

### 2.6 RECEPTACLES AND SWITCHES:

- A. On the finish plate, use a label, or legibly write with indelible ink on the back, the circuit to which each device is connected.

### 2.7 JUNCTION AND PULL BOXES:

- A. On the cover use a label, or legibly write with indelible ink, the panel number, circuit number and voltage for each box.

## PART 3 - EXECUTION

## 3.1 GRAPHICS:

- A. Coordinate names, abbreviations and designations used on Drawings with equipment labels.

## 3.2 CONDUCTOR IDENTIFICATION:

- A. Apply markers on each conductor for power, control, signaling and communications circuits where wires of more than one circuit are present.
- B. Match conductor identification used in panelboards, shop drawings, Contract Documents and similar previously established identification for work included in Divisions 26,27, and 33.

## 3.3 EQUIPMENT/SYSTEM IDENTIFICATION:

- A. Install an engraved label on each major unit of electrical equipment, including but not limited to the following items:
  - 1. Disconnect switches, identify item of equipment controlled.
  - 2. Relays.
  - 3. Contactors.
  - 4. Time switches.
  - 5. Override switches.
  - 6. Service disconnect and distribution switches, identify connected load.
  - 7. Branch circuit panelboards.
  - 8. Central or master unit of each electrical system, including communication/signal systems, unless the unit incorporates its own self-explanatory identification.
- B. Label shall identify panel, voltage, and electrical source. Each electrical panel ID should start with number where "2" will indicate 208/120V system and "4" will indicate 480/277V system. Example: 2A4/XFMR-T1/MDP4 208/120V identifies 208/120V Panel 2A4, fed from XFMR-T1, fed from MDP4. Emergency panels should have letter "E" after the number 2 or 4 in panel ID. Example: 4ED, 2E1.

## 3.4 APPLICATION:

- A. Install engraved labels on the inside of flush panels, visible when door is opened. Install label on outside of surface panel.
- B. Install signs at locations detailed or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment.
- C. Where signs are to be applied to surfaces, which require finish, install identification after completion of painting.

END OF SECTION

## SECTION 26 0923 - LIGHTING CONTROL DEVICES

## PART 1 - GENERAL

## 1.1 SUMMARY:

## A. Section Includes:

1. Occupancy sensors.

## B. Related Sections:

1. Section 26 0519, Low-Voltage Electrical Power Conductors and Cables.
2. Section 26 2726, Wiring Devices.
3. Section 26 0553, Identification for Electrical Systems.

## 1.2 SUBMITTALS:

- A. Product Data: Submit product catalog cut sheets for occupancy sensors.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS:

- A. Occupancy Sensor: WattStopper or approved.

## 2.2 OCCUPANCY SENSORS:

- A. Occupancy sensor shall be used to control lighting. They shall provide complete coverage of area to prevent nuisance OFFs even when the only activity is writing on a desktop or typing at a computer keyboard. Occupancy sensor circuits shall be wired to allow OFF override of the lighting in the area. The occupancy sensor system shall be designed to have no effect on power quality. Occupancy sensor and their related relays shall incorporate "zero-cross circuitry":
  1. Classrooms: Two dual technology occupancy sensors shall be used. Sensors shall be set to time-out after 10 minutes of no activity.
  2. High Ceiling Areas: Passive Infrared (PIR) sensors shall be used in high ceiling areas per manufacturer's installation requirements. Wire guards are required to protect sensors from projectiles in all installations.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Control Devices:

1. Install time switches and other automatic control devices in accessible locations near the source of power or grouped at a common location in mechanical rooms or similar spaces.

END OF SECTION

## SECTION 26 2726 - WIRING DEVICES

## PART 1 - GENERAL

## 1.1 SUMMARY:

- A. Section Includes:
  - 1. Wall switches.
  - 2. Receptacles.
  - 3. Device plates.
  - 4. Surface covers.

## 1.2 SYSTEM DESCRIPTION:

- A. Provide devices and finish plates for a complete and operational electrical system.

## 1.3 SUBMITTALS:

- A. Provide Product Data for the Following Equipment:
  - 1. Wall switches.
  - 2. Receptacles.
  - 3. Finish plates.
- B. Provide Product Data for Project Closeout for the Following Equipment, see Project Close-out Requirements in Division 1:
  - 1. Wall switches
  - 2. Receptacles.
  - 3. Finish plates.

## 1.4 REGULATORY REQUIREMENTS:

- A. Conform to requirements of the NEC, latest adopted version with amendments by local AHJs.
- B. Furnish products listed by UL or another testing firm acceptable to AHJ.
- C. Federal Specification Compliance: Comply with Federal Specification WS896 and WC596 for switches and receptacles respectively.
- D. NEMA Configuration: Comply with NEMA configurations and standards for general and special purpose wiring devices.

## PART 2 - PRODUCTS

## 2.1 WALL SWITCHES:

- A. Characteristics: Toggle type, quiet acting, 20 amp, 120/277 volt, UL listed for motor loads up to 80 percent of rated amperage. Leviton 1221, Pass & Seymour 20AC1, Hubbell 1221.
- B. Pilot Light Switches: Lighted handle, toggle type, red unless noted otherwise, neon pilot lamp. Pilot lamp energized when load is energized. Leviton 1221-PL, Pass & Seymour 20ACI-PL, Hubbell 1221-PL.
- C. Key Switches: 20 amp/120-277 volt, black key guide. Pass & Seymour 20ACI-L single pole keyed switch.
- D. Finish: Provide Architect with optional colors for selection prior to ordering.
- E. Appearance: Provide lighting switches and receptacles of common manufacturer and appearance.

## 2.2 RECEPTACLES:

- A. Finish: Type 302 stainless steel, satin finish, beveled edge. Receptacles connected to emergency circuits, red finish.
- B. Characteristics: Straight parallel blade 20 amp, 125 volts, 2-pole, 3-wire grounding, grey finish. Leviton 5352, Pass & Seymour 5352, Hubbell 5352.
- C. Isolated Ground Receptacle: Orange urea finish with isolated ground. Hubbell IG-5362, Leviton, Pass & Seymour.
- D. Isolated Grounding Surge Suppressor Duplex Receptacles: 20 amp, 120 volt, specification grade, three level MOV protection for phase to neutral, phase to ground, and neutral to ground. Indicator light on continuously when protection is active. Indicator light flashes when protection circuit has failed. Leviton 5280-IGI.
- E. Ground Fault Interrupter: Feed through type, 20 amp, 125VAC, specification grade. Hubbell GF-5362GY.
- F. Wet Locations: Weatherproof receptacles installed in wet locations, approved for location and use.
  - 1. Single Receptacle Cover: Crouse & Hinds WLR5-5-20. Arrow-Hart non-continuous use approved.
  - 2. Duplex Receptacle Covers: Crouse & Hinds WLRD-5-20 Non-continuous use approved.
  - 3. Cord Caps: Equip utilization equipment connected to wet location receptacles with barrel type plug similar to Hubbell 5266-C.
  - 4. Provide continuous use cover with cover capable of closing over energized cord cap with bottom aperture for cord exit.
  - 5. Special Purpose Receptacles: Refer to Drawings for NEMA Standard Specification.

## 2.3 FINISH PLATES:

- A. Material: 18 percent chrome, 8 percent nickel, Type 302 stainless steel, smooth satin finish metal. Hubbell S Series, Leviton, Pass & Seymour.
- B. Telephone/Signal System Device Plates: Activated outlets to have coverplate to match modular jack. Hubbell S Series.

## 2.4 WALL DIMMERS:

- A. Type as indicated on drawings compatible with load controlled (i.e., electronic ballast, low voltage luminaire, and the like). Finish to match wall switches. Size dimmers to accept connected load. Do not cut fins. Where dimmers are ganged together, provide a single multi-gang coverplate.

## 2.5 SURFACE COVERS:

- A. Material: Galvanized or cadmium plated steel, 1/2-inch raised industrial type with openings appropriate for devices installed on surface outlets.
- B. Cast Box and Extension Adaptors: Aluminum, with gasket, blank. Single gang, Bell 240-ALF, Carlon, 2-gang, Bell 236-ALF, Carlon, or approved.

## PART 3 - EXECUTION

## 3.1 PREPARATION:

- A. Protection:
  - 1. Devices: Upon installation of wall plates and receptacles, advise Contractor regarding proper and cautious use of convenience outlets. At time of substantial completion, replace those items which have been damaged, including those burned and scored by faulty receptacles or cord caps.
  - 2. Finish Plates and Devices: Do not install items until finish painting is complete. Scratched or splattered finish plates and devices not acceptable.

## 3.2 INSTALLATION:

- A. Switches shall be located in the space that they control. Control switches shall be provided at all entrances to space. Switches shall be located by each of the doors. Switches in corridors and public spaces shall be keyed switches.
- B. Plumb: Install devices and finish plates plumb with building lines and equipment cabinets.

- C. Orientation:
  - 1. Wall Mounted Receptacles: Install with long dimensions oriented vertically at centerline height shown on Drawings or specified herein.
  - 2. Vertical Alignment: When more than one outlet is shown on Drawings in close proximity to each other, but at different elevations, align the outlets on a common vertical centerline for best appearance. Verify with Architect.
  
- D. There shall be no more than six convenience outlets per circuit. Provide a minimum of four convenience outlet circuits in each classroom alternating between outlets. Classroom outlet circuits shall not be used in other rooms or corridors:
  - 1. Provide single circuit outlets for the following, and where directed or required for a specific use: Classroom projectors, or other display equipment

### 3.3 FIELD QUALITY CONTROL:

- A. Wiring Device Tests: Test wiring devices to ensure electrical continuity of grounding connections, and after energizing circuitry, to demonstrate compliance with requirements. Test receptacles for line to neutral, line to ground and neutral to ground faults. Correct any defective wiring.

END OF SECTION

## SECTION 26 2800 - LOW-VOLTAGE CIRCUIT PROTECTIVE DEVICES

## PART 1 - GENERAL

## 1.1 SUMMARY:

- A. Section Includes:
  - 1. Toggle type disconnect switches.
  - 2. Safety switches.
  - 3. Fuses.
  - 4. Circuit breakers.
  - 5. Fuse cabinet.

## 1.2 SYSTEM DESCRIPTION:

- A. Provide disconnect switches as required by NEC for a complete and operational electrical system.

## 1.3 SUBMITTALS:

- A. Provide product data for toggle type disconnect switches, manual motor starters, and safety disconnect switches.
- B. Provide product data for project closeout, see Project Closeout Requirements in Division 01.
- C. Product Data:
  - 1. Provide instantaneous let-through current curves and average melting time current curves for fuses supplied to project.
  - 2. Provide product data and time/current trip curves for circuit breakers supplied to project.

## 1.4 REGULATORY REQUIREMENTS:

- A. Conform to requirements of the NEC, latest adopted version with amendments by local AHJs.
- B. Furnish products listed by UL or another testing firm acceptable to AHJ.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS:

- A. Toggle Type Disconnect Switches: Arrow-Hart, Bryant, Hubbell, Leviton, Pass & Seymour, Slater, or approved.
- B. Safety Switches: Cutler-Hammer/Westinghouse, General Electric, Siemens, Square D, or approved.
- C. Fuses: Cooper-Bussmann, Ferraz Shawmut, Littelfuse, or approved equal.
- D. Circuit Breakers: Eaton, General Electric, Siemens, Square D, or approved. New circuit breakers installed in existing panelboards to match manufacturer, type, and SCCR rating of existing breakers.
- E. Fuse Cabinet: Bussmann, Circle AW, Gould-Shawmut, Littelfuse, Siemens, Square D, or approved.

## 2.2 TOGGLE TYPE DISCONNECT SWITCHES:

- A. Rating: 120 volts, 1-pole, 20 amp, 1 HP maximum.
- B. Enclosure: NEMA 1 indoors, NEMA 3R raintight outdoors.

## 2.3 SAFETY SWITCHES:

- A. Heavy duty, fused type, dual rated, quick-make, quick-break with fuse rejection feature for use with Class R fuses only, unless another fuse type is specifically noted.
- B. Enclosures NEMA 1 indoors, NEMA 3R raintight outdoors.
- C. Switches clearly marked for maximum voltage, current and horsepower.
- D. Equip enclosure with defeatable cover interlock.
- E. Switches rated for maximum available fault current.

## 2.4 FUSES:

- A. Characteristics: Dual element, time delay, current limiting, nonrenewable type, rejection feature.
- B. Combination Loads: Class RK1, 1/10 to 600 amp, UL Class L, above 600 amps.
- C. Motor Loads: UL Class RK5, 1/10 to 600 amp.
- D. Fuse pullers for complete range of fuses.

## 2.5 MOLDED CASE CIRCUIT BREAKERS:

- A. One, two or three-pole bolt on, single handle common trip, rated 15 to 800 amp, 250VAC or 600VAC as indicated on Drawings.
- B. Overcenter toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.
- C. Calibrate for operation in 40C ambient temperature.
- D. 15 to 100 Amp Breakers: Permanent trip unit containing individual thermal and magnetic trip elements in each pole.
- E. Greater than 100 Amp Breakers: Variable magnetic trip elements set by a single adjustment. Provide push-to-trip button on cover on breaker for mechanical tripping.
- F. Provide removable load lugs, UL listed for compression type lugs, copper conductors only.
- G. Provide all circuit breakers series rated and when series combination ratings are applied, identify all equipment enclosures as required by NEC 110.22.

## PART 3 - EXECUTION

### 3.1 INSTALLATION:

- A. Provide disconnect switch at each motor location within 5-feet unless otherwise noted.
- B. Motors within sight of and not more than 20-feet from motor branch circuit device do not require a disconnect switch at the motor. Provide locking device on circuit protective device.
- C. Recessed fractional horsepower exhaust ceiling or wall fan units; no disconnect switch required at motor if unit is recessed, unless shown otherwise on Drawings.
- D. Switches disconnect all phase legs.
- E. Coordinate fuse ampere rating with installed equipment. Fuse ampere rating variance between original design information and installed equipment, size in accordance with Bussmann Fusetron 40C recommendations. Do not provide fuses of lower ampere rating than motor starter thermal units.
- F. Fuses: For each class and ampere rating of fuse installed, provide the following quantities of spares for quantity of fuses installed:
  - 1. 0 to 24: Provide 6 spare.
  - 2. 25 to 48: Provide 9 spare.
  - 3. 49 and Above: Provide 12 spare.

## G. Circuit Breakers:

1. Provide circuit breakers, specified herein and on Drawings, for installation in panelboards, individual enclosures or combination motor starters.
2. Provide ground fault interrupter circuit breakers for equipment in damp or wet locations.
3. Provide device on handle to lock breaker in "ON" position for breakers feeding time switches, night lights and similar circuits required to be continuously energized.

END OF SECTION

## SECTION 265000 – LIGHTING

## PART 1 - GENERAL

## 1.1 REQUIREMENTS:

- A. Provide lighting required for a complete and code compliant installation that meets and/or exceeds the requirements of the contract documents.
- B. Coordinate, receive, mount, connect, and place into operation all equipment unless otherwise noted. Provide all conduit, wire, connectors, hardware, and other incidental items necessary for properly functioning lighting system as described herein. Maintain performance criteria stated by manufacturer without defects, damage, or failure. Comply with manufacturer's product data, including shop drawings, technical bulletins, product catalog installation instructions, and product carton instructions for installation.
- C. Exit Lights: LED lighting, with stencil lettering, aluminum or PVC housing. "EXIT" spelled out and back-lit.
- D. Egress Lighting: In addition to code requirements, classrooms and stairways shall have egress lighting. Provide code minimum or better foot-candles for egress lighting.

## 1.2 SUBMITTALS:

- A. Provide product data on each fixture type including picture, dimensions, specifications, coefficients of utilization, lamp, ballast and other pertinent information.

## 1.3 QUALITY ASSURANCE:

- A. If the catalog number of a specified fixture should conflict with the fixture description, ceiling type, mounting or the general lighting specifications, such conflicts shall be brought to the attention of the Architect and Owner prior to bidding.

## 1.4 WARRANTY:

- A. Driver Manufacturer's Warranty: Not less than 5 years for LED drivers, based on date of manufacturer embossed on driver, current with installation date. Warranty includes normal cost of labor for replacement of ballast/driver
- B. Driver warranty: 5 years for LED driver.

## 1.5 ADDITIONAL REQUIREMENTS:

- A. Furnish 2 percent extra lens or louvers for each size and type of luminaire.

- B. Furnish 5 percent extra LED drivers for each size and type.

## PART 2 - MATERIALS

### 2.1 MANUFACTURERS:

- A. The lighting designated for this project is based on fixture types and manufacturers specified in the Drawings. To request a substitution, submit written request showing how the substitution clearly meets or exceeds the design intent, functionality, quality and appearance of the specified fixture:
  - 1. Approved manufacturers: Acuity/Lithonia, Eaton/Cooper Industries, ETC or Philips.

### 2.2 MATERIALS:

- A. Make sure recessed fixtures have trims that fit neatly and tightly to the surfaces in which they are installed without leaks or gaps. Where necessary, install heat resistant non-rubber gaskets to prevent light leaks or moisture from entering between fixture trim and the surface to which they are mounted.
- B. Make sure lighting is high efficiency type.
- C. Refer to description and manufacturers in Luminaire Schedule on Drawings.
- D. Where recessed luminaires are installed in cavities intended to be insulated, provide IC rated luminaires or other code approved installation.
- E. Luminaires installed under canopies, roof or open porches and similar damp or wet locations shall be UL labeled as suitable for damp or wet locations.
- F. Make sure recessed luminaire frames are compatible with ceiling material installed at particular luminaire location. Provide proper trim, frame and other accessories as required for complete installation. Review architectural drawings for exact ceiling type and adjust type of mounting hardware as necessary to install within exact ceiling type. If a difference between architectural drawings ceiling type and lighting fixture schedule mounting is found, then notify project engineer.
- G. LED Luminaires:
  - 1. LED light fixtures to be in accordance with DLC, IESNA, NFPA, UL, and as specified.
  - 2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
  - 3. LED drivers shall include the following features unless otherwise indicated:
    - a. Minimum efficiency: 85% at full load.
    - b. Minimum Operating Ambient Temperature: -20° C. (-4° F.)
    - c. Input Voltage: multi-volt or autosensing, unless otherwise specified.
    - d. Integral short circuit, open circuit, and overload protection.
    - e. Power Factor:  $\geq 0.95$ .
    - f. Total Harmonic Distortion:  $\leq 20\%$ .

4. LED modules to include the following features unless otherwise indicated:
  - a. Comply with IES LM-80 standards.
  - b. Minimum CRI 80 and color temperature 3500° K unless otherwise specified.
  - c. Minimum Rated LM-80 life: 60,000 hours.
  - d. Light output lumens as indicated in the fixture schedule.

### PART 3 - EXECUTION

#### 3.1 PREPARATION:

- A. Review Drawings and determine exact ceiling types in each area and provide suitable mounting frames as required.
- B. Make sure all required mounting, bracing, and/or supports are in place.
- C. Coordinate installation with other trades to make sure there are no issues.

#### 3.2 INSTALLATION:

- A. Make sure fixtures are left clean at the time of acceptance of the work with every lamp in operation. If fixtures are deemed dirty by the Owner's Authorized Representative at completion of the project, then clean them at no additional cost to the Owner.
- B. Make sure fixtures are carefully aligned, leveled in straight lines, and located as shown on the architectural reflected ceiling plan. Make sure the final decision as to adequacy of support and alignment is given by the Owner's Authorized Representative. Make sure the fixture is supported by separate means from the building structure and not from the ceiling system, ductwork, piping or other systems.
- C. Make sure fixtures are aimed or installed to provide the lighting pattern for which the fixture is designed.
- D. Make sure fixtures are supported to meet current seismic standards, including sway bracing.
- E. Make sure all light outlets are supplied with a fixture. Make sure outlet symbols on the drawings without a type designation have a fixture the same as those used in similar or like locations.
- F. Make sure fixture stem or chain length for industrial reflector or bare lamp strip fixtures are appropriate for the space and for coordination with other work such as ducts and piping.
- G. Make sure fixtures are left clean at the time of acceptance of the work and every lamp is in operation. The contractor is solely responsible for cleaning or protecting fixtures from dirt, dust, paint, debris, etc.
- H. Prior to the purchase of any fixture, verify the finish with the Architect and Owner.

- I. Where fixtures are mounted under cabinets, in soffits, covens, or other physically restricting spaces, verify the contractor that the fixtures will fit the space prior to ordering.
- J. Thermal Protection:
  - 1. At insulated ceilings provide thermal protection at fixtures with a field fabricated box (metal, sheetrock, etc.) complying with all clearance requirements.
  - 2. Install in compliance with manufacturer's instructions and code requirements.

### 3.3 TESTS:

- A. Test operation and function of all lighting in accordance with switching options.

END OF SECTION

DIVISION 27 SPECIFICATIONS

SECTION 27 0528 PATHWAYS FOR COMMUNICATIONS SYSTEMS

## SECTION 27 0528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

## PART 1 - GENERAL

## 1.1 SUMMARY:

- A. Work Included: Telephone/Data Raceway System.
- B. Related Work:
  - 1. Section 26 0533, Raceway and Boxes for Electrical Systems.
  - 2. Section 26 2726, Wiring Devices.
  - 3. Section 26 0553, Identification for Electrical Systems.

## 1.2 REFERENCES:

- A. All referenced documents are to be the latest version, including addendum, in publication at time work is requested:
  - 1. ANSI/TIA-526-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant OFSTP-7
  - 2. ANSI/TIA-526-14-B-1998 Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant OFSTP-14A
  - 3. ANSI/TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises
  - 4. ANSI/TIA-568-C.1 Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements
  - 5. ANSI/TIA-568-C.2 Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling
  - 6. ANSI/TIA-568-C.3 Commercial Building Telecommunications Cabling Standard, Part 3: Fiber Optic Cabling Components Standards
  - 7. ANSI/TIA -569-B: Commercial Building Standard for Telecommunications Pathways and Spaces
  - 8. ANSI/TIA-598 Color Coding of Fiber Optic Cables
  - 9. ANSI/TIA-606-A the Administration Standard for the Telecommunications Infrastructure of Commercial Building
  - 10. ANSI/TIA-607-B Commercial Building Grounding and Bonding Requirements for Telecommunications
  - 11. ANSI/TIA-758 Customer Owned Outside Plant Telecommunications Cabling Standard.
  - 12. NFPA-70 National Electric Code (NEC)
- B. In addition to the above all design documents shall comply with codes and requirements of the local Authority Having Jurisdiction (AHJ).

## 1.3 SYSTEM DESCRIPTION:

- A. Classrooms will have a minimum of three duplex data drop locations on walls and one data drop location in the ceiling or wall at the LCD projector or TV location.
- B. Topology:
1. Data Connections: Shall be an interconnection from the patch panel to an Ethernet switch using modular patch cables equal to the medium installed for horizontal (station) cable. An Ethernet switch in an MDF/IDF shall be connected to the intra-building data backbone cabling using a 50/125 $\mu$ m fiber optic patch cable or CAT 5E ethernet cable as appropriate. In the MDF, the data backbone cables shall connect to the network hardware using appropriate length patch cables. Active Electronics and fiber/copper patch cables will be furnished and installed by the District. One exception to this is when contractors are installing District provided wireless access points, in this case the contractor will install WAP and CAT 6A patch cable.
  2. Voice Over IP (VoIP): Connections will be provided using the data outlets described above. A PoE Ethernet switch in an IDF shall be connected to the intra-fiber optic patch cable connecting the Ethernet switch to the rack mounted fiber optic cabinet, the PoE switch will be installed by the District. Active Electronics and fiber/copper patch cables will be furnished and installed by the District.
  3. Wireless Access Point (WAP): The District has standardized on an Aruba enterprise wireless solution. Data jack will consist of a dual CAT 6A-plenum cable to each WAP. WAP will be interconnected at each MDF/IDF to a District provided/installed PoE switch. Flush mount in ceiling using standard flush mount face plate.
    - a. WAP connections shall be an interconnection from the patch panel to a powered Ethernet switch (PoE) using CAT 6A modular patch cables. The PoE Ethernet switch shall be connected to the intra-building data backbone cabling using a 50/125 $\mu$ m optic patch cable connecting the Ethernet switch to the rack mounted network cabinet. Active Electronics will be furnished and installed by the District.
  4. Structured Cabling: Installation of raceways/pathways for telecommunication distribution systems shall be in accordance with applicable portions of ANSI/TIA-569-B. Horizontal cabling shall be routed from each Data Outlet to a frame room using a combination of boxes, conduit, open cabling supports, and cable tray. In new construction, cabling pathways shall be concealed in walls, casework, concrete slabs, and above ceilings whenever possible. In renovations to existing spaces, the horizontal and backbone cabling may be routed in surface raceway when no other cost-effective options exist.
    - a. Open Cabling: Open cabling supports shall be installed parallel, or at right angles, to the building structure and shall be permanently anchored to building structure or substrates using beam clamps, drop wire, or threaded rod hanger brackets. Open cabling supports shall be J-hook type cable supports with an open-top and wide base designed for supporting telecommunications cabling. J-hook supports should be sized in accordance with manufacturer's recommendations for quantity of cables supported. Fiber optic backbone cabling shall be installed with inner duct when routed using open cabling methods.
    - b. Conduits: Conduit pathway shall be provided for horizontal and backbone cabling routed in inaccessible spaces including walls, floors, and ceilings.

- c. Conduits to Data Outlets shall be a minimum of 1" diameter. Conduit pathways and sleeves shall be EMT conduit. All conduits shall have appropriate bushings installed on the ends prior to cabling being pulled. In case EMT conduit cannot be used, 1¼ flexible metallic conduit may be used. Nylon pull strings shall be used in all conduit sleeves and pathways. Runs shall be less than 90 meters (295 ft) in length and contain no more than two 90° bends.
- d. Fire Stopping: All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Label all firewall penetrations as indicated on the As-Built Drawings. Any penetrations left unused shall be sealed.
  - 1) Fire stop systems shall be UL listed and shall be acceptable to the local fire and building authorities having jurisdiction over this work.

C. Data Outlets:

1. Standard Data Outlets: The Standard Data Outlet shall be housed in a recessed 25/8" deep x 4" square outlet box flush to the wall with single gang mud ring. A 1" conduit and pull string shall be installed from the outlet box to an accessible ceiling space. Appropriately rated bushings shall be installed on the end of the conduit stubbing into the accessible ceiling space.
2. All Data Outlets shall be labeled in accordance with BSD labeling standard for data drops. The labels shall be non-removable, typed or machine-engraved. The label shall identify the Data Distribution Room, patch panel, and port number on the patch panel to which the horizontal cable terminates. Data Outlet labels shall be installed into the recess label field on the faceplate. For ceiling heights 15' or less, the label must be of large enough font to be read from the ground.
3. The current District labeling scheme is:
  - a. Frame room number – Panel in Frame – Port on Panel
  - b. In new construction, MDF will be "Frame room 1". IDF 2 will be "Frame room 2 and will continue sequentially for any additional IDFs. Panels will start with "Panel 1" at the top on the Rack. If additional panels are needed in other racks, they will continue with sequential numbers. Port label will indicate port number position on that panel (i.e., F1-P2-26). No deviation from the district labeling scheme will be allowed.

D. Wireless Access Points (WAP):

1. The system must be designed in conjunction with the District Aruba Wireless Design Consultant and based on the coverage range for IEEE 802.11b/g, n, a/c. The WAP shall be located so that WAPs provide adequate capacity (up to 80 devices per classroom in a high school, 60 devices per classroom in middle school and 40 devices per classroom in elementary) for that area. Two CAT 6A cables will be installed from the serving MDF or IDF to each WAP location. Provide two CAT 6a data drops in the location determined by the design. A 10'-0" service loop shall be coiled in the ceiling space above the WAP without exceeding the manufacturer's bend radius.

2. WAPs should never be planned or mounted more than 30' above ground level. WAPs in a Gym or other areas that damage could be easily sustained will be mounted on a vertical surface within a NEMA polycarbonate enclosure measuring 14" x 12" x 6" with a clear door and locking latch.

E. Classrooms:

1. Data outlets in classrooms shall be located to provide connectivity supporting instruction. The following are minimum specifications. Actual room distribution is determined by project design.
2. The number of jacks for student computers is recommended to be wall locations as shown on plans with the standard data outlet having two CAT 6 RJ45 jacks – one white and one orange. WAP outlet locations should be determined by consulting with the District Wireless Design Consultant.

- F. Clock Systems: Provide GPS transmitter clock system (72MHz local transmitter with external antenna Primex #14000-E) located with best signal distribution to minimize the need for additional repeaters. Provide dedicated electrical circuits to feed transmitters. Where existing clock system is in place, install components compatible with existing system.

1.4 SUBMITTALS:

- A. Submit copies of the certification of the company and names of staff that will be performing the installation and terminations.
- B. Receive approval from the BSD Representative on all substitutions of material.

PART 2 - PRODUCTS

2.1 EQUIPMENT:

- A. Raceway components as applicable under related sections.
- B. Wiring, instruments and equipment will be furnished and installed by others.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install electrical work in telecommunications equipment rooms as shown on Drawings. Coordinate with the telephone company, Owner's Representative, with other trades working in the area.
- B. Install plastic-jacketed pull lines printed with accurate sequential footage in all empty conduits longer than 15-feet or with more than one 90-degree bend.

- C. Provide copper grounding bus bars and listed copper conductors at each terminal board, bonded through to the main equipment room and to the building ground grid, per ANSI/EIA/TIA-607.
- D. Provide insulated bushings on all conduits and sleeves.
- E. Conduit bodies (condulets) are not to be used in data raceway system.
- F. Install listed firestop material in all sleeves.
- G. Seal and cap all conduits entering from outside of the building.

END OF SECTION

DIVISION 28 SPECIFICATIONS

SECTION 28 0500	COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY
SECTION 28 1300	ACCESS CONTROL
SECTION 28 4600	FIRE DETECTION AND ALARM

## SECTION 280500 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

## PART 1 - GENERAL

## 1.1 REQUIREMENTS:

- A. This section specifies the requirements necessary to furnish and/or install equipment and systems.
- B. The contract price will be payment in full for furnishing all labor, materials, tools, equipment and incidentals necessary to complete the Work as specified.
- C. Connect equipment and ensure equipment is electrically complete and operational unless otherwise noted.
- D. Provide wires, cables, connector, boxes, devices, finish plates and the like for a complete and operational electrical system.
- E. Coordination of work:
  - 1. Conduct Work in a manner to cooperate with all other trades for proper installation of all items of equipment. Consult the Drawings of all other trades or crafts to avoid conflicts with cabinets, counters, equipment, structural members, etc. In general, the architectural drawings govern, but conflicts shall be resolved with the Engineer/Owner prior to rough-in.
  - 2. Verify the physical dimension of each item of electrical equipment to fit the available space. Coordination of the equipment to fit into the available space and the access routes through the construction shall be the Contractor's responsibility.
  - 3. Coordinate rough-in and wiring requirements for all equipment with equipment installer and equipment supplier. Make installation in accordance with rough-in and wiring diagrams provided by equipment supplier for Contractor's use. Report immediately to Architect and Owner's Authorized Representative, any deviation between Contract Documents and actual equipment requirements.
  - 4. Coordinate all aspects of the installation and other utility services with the appropriate serving utility, owner and/or system administrator. No additional compensation will be allowed the Contractor for connection fees or additional Work or equipment not covered in the Drawings or Specifications that are a result of policies of the serving utility, owner and/or system administrator.
  - 5. In the event of a conflict between the Specifications and/or Drawings and the local or regional regulatory rules/codes/standards, in addition to the applicable codes and/or standards, the requirements of the more stringent shall prevail.

## F. Drawings:

1. The Drawings accompanying these Specifications are design drawings and generally are diagrammatic - indicating approximate locations of equipment, devices, wiring and/or associated hardware and systems. They do not show every detail, device, wire and/or associated hardware and system which may be required for installation to complete the system. Minor deviations in methods or arrangements to suit construction conditions are permissible.

## G. Programing:

1. In all associated Division 28 systems the following naming conventions shall be used to identify points within each system:
  - a. Room signage-proper name-record door ID:
    - 1) Example: 103D-Principleoffice-103D-A

## H. Network:

1. Network switches will be provided by the District. All other network associated components called out in the bid documents are to be provided under contract.

## I. Training:

1. Contractor shall provide training to District personnel including, but not limited to, how to monitor status readouts and history logs of systems, video surveillance management, required maintenance, and troubleshooting. Training will also include the review of complete As-Built
2. Drawings, Operation and Maintenance (O&M) Manuals, contact names and phone numbers for factory support. At minimum the following training sessions shall be provided:
  - a. Maintenance and Public Safety Staff:
    - 1) Minimum 1-day session during commissioning to include software as well as system training
    - 2) Minimum 1-day session post commissioning
    - 3) Minimum 1-day session three months after building opens
    - 4) Minimum 1-day session 11 months from commissioning
  - b. School Staff:
    - 1) Minimum 1-day sessions for each distinct system provide training for the building owner and their staff.

## 1.2 SUBMITTALS:

- A. Submittal documents shall be digital, and shall be of original document quality, clearly marked to indicate equipment options and accessories to comply with the contract documents. Photocopies of hand marked documents will be rejected and returned for re-submittal.
- B. Provide all required submittal data in PDF format on DVD or make data available to client via online secure storage with minimum of 1 year access to online storage. Organize digital submittals by specification section and separate within separate folders labeled with applicable specification section. Provide a table of content showing submittals and their applicable specification section. Ensure PDF documents have clear legible titles based on the content of the submittal. Items of similar nature may be grouped in a single PDF if that PDF includes a clearly labeled table of contents and each Page is clearly identified according to the item. Otherwise, provide individual PDFs for each item of a submittal.
- C. Product Data: (required submittal data)
  - 1. Bill of Materials, including a description of any differences between the specified and the proposed equipment.
  - 2. Manufacturer's product literature, model specifications and performance data, sufficient to verify compliance to specification requirements.
  - 3. Manufacturer's published warranty documents.
  - 4. Include data indicating dimensions, finishes, accessories, hardware, ampacity, rating and listing.
  - 5. Installation instructions as applicable.
  - 6. If the contractor wishes to furnish materials other than those indicated in the contract document then contractor is solely responsible for providing a written request with clear proof showing how substitute meets and/or exceeds the design intent and contract requirements.
- D. Shop Drawings: (required submittal data)
  - 1. Show fabrication and installation details, including plans, elevations, and sections of components and attachments to other construction elements. One-line diagrams and wiring diagrams for assembly, and components, interconnection wiring diagrams.
- E. O&M Manuals: (required submittal data)
  - 1. Provide product cut sheet, installation instructions, operating/programming instructions, a parts list with local suppliers, shop drawings, one-lines, diagrams, warranties, and a local repair/maintenance provider.

- F. Coordination Drawings: (required submittal data)
  - 1. Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around equipment. Show equipment layout and relationships between electrical components and adjacent structural, mechanical, and/or architectural elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
- G. Warranties: (required submittal data)
  - 1. Provide warranties for all materials and equipment as available by the manufacturer or required by these contract documents.
- H. Samples: (required submittal data)
  - 1. Submit samples for finish, color, and texture as available for each submittal item.
- I. Seismic Qualifications: (required submittal data)
  - 1. Provide Seismic Qualification Certificates for equipment requiring seismic restraint either by manufacturer, AHJ, code, contract documents, or owner.
  - 2. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 3. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 4. Detailed description of equipment anchorage devices on which the certification is based, and their installation requirements.

### 1.3 QUALITY ASSURANCE:

- A. Ensure components and/or systems are listed and labeled by a nationally recognized testing laboratory (NRTL) including but not limited to (UL, ETL, CSA, or FM), labeled and/or listed as part of a UL-labeled assembly, or evaluated by a third party acceptable to the authority having jurisdiction (AHJ) as suitable for the use intended. Ensure all labels are applied at the manufacture's factory or facility prior to shipment.
- B. Ensure equipment meets applicable codes and requirements. Where conflicting requirements occur between other required codes or standards, the more stringent requirements shall apply.
- C. Ensure installer has a minimum of 5 years of experience in performing the work they are engaged in, can provide clear examples and supporting documents to validate their experience to the satisfaction of the owner if requested.
- D. Contractor is required to obtain and pay for permits, plan review, and inspections from local AHJs.

**1.4 DELIVERY, STORAGE, AND HANDLING:**

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic. Contractor is solely responsible for delivery, storage, and handling which includes but is not limited to storage space, delivery access, equipment for loading/unloading, physical protection, protection from weather, and/or damages.
- B. Handle material/equipment in accordance with manufacturer's written instructions. Lift only by lifting lugs or devices provided for the purpose. Handle carefully to avoid damage to internal components, enclosure, and finish. Contractor is solely responsible for damages, ensure necessary precautions and measures are taken to ensure no damages.
- C. Ensure material/equipment is properly packed and weather-protected to avoid damage or breakage during transport, rough handling, storage, etc.
- D. Contractor is responsible for the makeup of each shipping section including the length, height, weight, etc.

**1.5 WARRANTY:**

- A. All equipment, manufacturer installation and labor will have a 3-year warranty unless otherwise stated.

**1.6 CODES AND STANDARDS:**

- A. NEC: National Electrical Code with Local Amendments, Latest edition
- B. NFPA: National Fire Protection Association
- C. ANSI: American National Standards Institute
- D. SFM: State and Local Fire Marshal
- E. IEEE: Institute of Electrical and Electronics Engineers
- F. NEMA: National Electrical Manufacturers Association
- G. UL: Underwriters' Laboratories, Inc. or equivalent testing lab
- H. Local and State Building Code, Latest edition with Amendments
- I. IES: Illuminating Engineering Society
- J. LPI: Lightning Protection Institute
- K. iNETA: International Electrical Testing Association (ATS and MTS)

## 1.7 DEFINITIONS:

- A. AHJ: Authority Having Jurisdiction
- B. BAS: Building automation system.
- C. Contract Documents: Drawings, Specifications, supplemental instructions, addendums and other written documents that define the roles, responsibilities, and “Work” under the construction Contract, and are legally-binding on the parties (Owner and Contractor)
- D. CPT: Control power transformer.
- E. DVD: Digital Video Disc, Electronic storage
- F. EMI: Electromagnetic interference.
- G. Engineer of Record: A Professional Engineer Registered in the State where the project is located who undertakes final design of the fire protection system.
- H. Furnish: To supply the stated equipment or materials.
- I. Install: To set in position and connect or adjust for use.
- J. LAN: Local area network.
- K. LED: Light-emitting diode.
- L. MCP: Motor-circuit protector.
- M. N.C.: Normally closed.
- N. N.O.: Normally open.
- O. Owner: Building/facility owner, landlord/lessor, tenant/lessee, Insurance Carrier or any designated representative of these entities.
- P. OCPD: Overcurrent protective device.
- Q. Provide: Furnish and Install equipment or materials
- R. Public Authorities: Local, State or Federal government body having jurisdiction over any portion of the project. This includes, but is not limited to: building departments, Fire Departments, Fire Marshals Offices, Aviation Authorities, Insurance Regulatory Boards, etc.
- S. PDF: Portable Document Format
- T. PWM: Pulse-width modulated.
- U. RFI: Radio-frequency interference.
- V. VFD: Variable Frequency Drive

- W. EMT: Electrical metallic tubing.
- X. IMC: Intermediate metal conduit.
- Y. RMC: Rigid metal conduit.
- Z. Seismic Restraint: A structural support element such as a metal framing member, a cable, an anchor bolt or stud, a fastening device, or an assembly of these items used to transmit seismic forces from an item of equipment or system to building structure and to limit movement of item during a seismic event.
- AA. OSSC: Oregon Structural Specialty Code

## PART 2 - MATERIALS

### 2.1 MANUFACTURERS:

- A. Ensure equipment and materials provided are from reputable manufacturers with qualified and proven experience in manufacturing the material specified within individual specification sections and/or shown on drawings. Manufacturers will have not less than 10 years of experience and proven track record manufacturing the materials, unless otherwise noted. Owner reserves the right to reject any equipment they deem to be of poor quality or ill-suited for the application intended.

### 2.2 MATERIALS:

- A. Ensure materials are new, of the best quality and American made. Ensure materials are manufactured in accordance with NEMA, ANSI, U.L. or other applicable standards.
- B. Provide material and equipment that is acceptable to AHJ as suitable for the use indicated. For example, provide wet labeled equipment in locations that are wet.
- C. Include special features, finishes, accessories, and other requirements as described in the Contract Documents regardless of the item's listed catalog number.
- D. Provide incidentals not specifically listed in contract documents but needed to complete and ensure a safe and satisfactory working system and/or systems.
- E. Provide fire stopping or fire rated pass-through for all penetrations through rated barriers.

## PART 3 - EXECUTION

### 3.1 PREPERATION:

- A. Coordinate activities with other trades to ensure complete and cohesive installation.

- B. Prepare equipment, material and/or work area in accordance with manufacturer's recommendations.
- C. Examine equipment, material and/or work area for compliance with installation tolerances, shop drawings, manufacturer's recommendations, working clearances, hazards, and/or other conditions affecting performance and installation.

### 3.2 INSTALLATION:

- A. General:
  - 1. Ensure an electrically complete and fully functional system for each item, material and/or equipment within the contract documents either exclusively shown in the electrical documents or other division.
  - 2. Ensure Installations are in accordance with the equipment manufacturer's instructions, the best industry practices and the Contract Documents. Where a conflict arises, notify the Engineer/Owner for clarification before Work is roughed in, Owner's decision will be final. Work installed without such clarification shall be removed and corrected by the Contractor at no cost to the Owner.
  - 3. Ensure installations are performed in a neat, finished and safe manner, according to the latest published NECA Standard of Installation and under competent supervision.
  - 4. Ensure installations comply with the latest local codes.
- B. Equipment Support:
  - 1. The Contractor is responsible to determine the means and methods of equipment installation and support. Ensure shop drawings showing seismic restraints for equipment bears the seal and signature of a structural Engineer registered in the state where the Work is being performed. Submit shop drawings to the Architect prior to fabrication. Calculations are to be included for all connections to the structure, considering localized effects.
  - 2. Ensure anchoring and bracing to the building structural elements is in accordance with all codes and regulations regarding seismic and design conditions.
  - 3. Ensure each fastening device and support for equipment, fixture, panel, outlet and/or cabinet is capable of supporting not less than four times the ultimate weight of the object or objects fastened or suspended from the building structure.
  - 4. Properly and adequately support fixtures installed under this Work from the building structure. Ensure supports are provided with proper alignment and leveling of fixtures. Ensure flexible connections where permitted to exposed fixtures are neat and straight, without excess slack, attached to the support device.
  - 5. Support all junction boxes, pull boxes or other conduit terminating housings located above the suspended ceiling from the floor above, roof or penthouse floor structure to prevent sagging or swaying.

## C. Alignment:

1. Install panels, cabinets and equipment level and plumb, parallel with structural building lines. Switchgear panels and all electrical enclosures shall fit neatly without gaps, openings or distortion. Properly and neatly close all unused openings with approved devices.
2. Fit surface panels, devices and outlets with neat, appropriate trims, plates or covers, without over-hanging edges, protruding corners or raw edges, to leave a finished appearance.

## D. Cutting and Patching:

1. Include cutting, patching and restoration of finishes necessary for this Work. Surfaces damaged by this Work and spaces around conduits passing through floors and walls shall be neatly patched and finished to match the adjacent construction, including painting or other finishes. Clean up and remove all dirt and debris. This Work shall all be performed to the satisfaction of the Owner's Authorized Representative.

## E. Firestopping:

1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate their through penetrating items. Ensure all voids between sleeve or core-drilled hole and pipe passing through are firestopped with approved compound.

## F. Cleaning:

1. Remove dirt, dust, and debris from equipment.
2. Ensure entire electrical system installed under this contract is clean, dust-free and in proper working order.
3. Vacuum interiors of electrical equipment enclosures clean.

## 3.3 TESTS:

- A. Provide component and system testing

## 3.4 CLOSEOUT:

- A. Upon closeout, the Architect and Engineering (A/E) firm shall provide a complete and accurate set of As-Built drawings and documents. Care should be taken to ensure the room numbering and identification scheme accurately cross-reference the contractor's documentation, field work, and systems programming.

END OF SECTION

## SECTION 28 3100 – INTRUSION DETECTION

## PART 1 - GENERAL

## 1.1 SUMMARY:

## A. Section Includes:

1. Section 26 0519, Low-Voltage Electrical Power Conductors and Cables.
2. Section 26 0533, Raceway and Boxes for Electrical Systems.

## 1.2 SYSTEM DESCRIPTION:

- A. Provide security and access control system for all entrance and exit portals to allow entry for authorized persons and deny entry to unauthorized persons.
- B. Provide appropriate alarm notification to monitoring personnel in event of intrusion detection.
- C. The District has standardized on the following manufacturers for the identified systems:
  1. Intrusion Alarm System shall be Bosch
  2. Access Control shall be Lenel
- D. Access Control System: The system shall include, but not be limited to, a system controller, input control modules, output control modules, reader interface modules, IP Network connectivity. Fully integrate all existing ADA compliant door operator systems with Access Control System.

## 1.3 SYSTEM OPERATION:

- A. Locate motion detectors in designated areas to detect unauthorized intruders.
- B. Install door contacts and automatic door locks at selected exterior doors as detailed.
- C. Power supplies shall be compatible with the access control equipment installed. Provide a quick disconnect (male/female connection) on the primary side of the device's transformer.
- D. Hardware:
  1. Tamper-resistant fasteners: Use only stainless steel screws with approved head design for exposed fasteners on security system devices and equipment in unsecured interior areas and outdoors.

- E. Corrosion Protection:
  - 1. All materials including bolts, straps, and screws shall be inherently corrosion resistant or protected against corrosion by corrosion-resistant materials approved for the purpose.
- F. Alarm Point Locations:
  - 1. First Floor rooms with windows on exterior Wall: Mount sensor by window at opposite end of room from door to look into the room and along window.
  - 2. First floor classrooms with windows on exterior wall: Mount sensor by window at opposite end of room from door to look into the room and along window.
- G. In the event of an alarm activation, the following lights shall be activated: egress way and all exterior spaces.

#### 1.4 SUBMITTALS:

- A. Provide manufacturer's specifications for all devices and components.
- B. Provide layout of security devices on reproducible architectural floor plan.
- C. Provide wiring diagrams indicating low voltage and line voltage requirements.
- D. Closeout: Provide final product data, record drawings (as-builts), operating instructions and maintenance manuals defining system features, procedures and troubleshooting guidelines at completion of project.

### PART 2 - PRODUCTS

#### 2.1 COMPONENTS:

- A. Provide components that are UL listed for this application and ADA compliant.

#### 2.2 MAGNETIC DOOR CONTACTS:

- A. Provide 3/4-inch diameter self-locking magnetic contacts.
- B. Coordinate with architectural door hardware requirements.
- C. Manufacturer: Bosch ISN-CTC75 or most current model. To meet both intrusion and access control operation, DPDT, Interlogix UTC 1078/1076 Series door contacts.

#### 2.3 MOTION DETECTORS:

- A. Provide detectors designed for security applications and capable of tamper protection using an internal switch.

- B. Locate to cover entrances, hallways and other critical areas of the facility.
- C. They shall have all functional device lighting / alert features activated. They shall be labeled with a number which can be read when standing at ground level. The number on the device shall match that on the point map and on the as-built drawings
- D. Manufacturers: Bosch, ISC-PPR1-W16 or most current model.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION:

- A. Install all devices as directed by manufacturer's instructions. Complete all electrical connections to all control circuits, locks, readers, PIN pads and low voltage wiring.
- B. Program the security and access control system to meet the functional and operational requirements of the Owner.

#### 3.2 PERFORMANCE TESTS:

- A. Test each individual portal to verify proper operation.
- B. Verify that all equipment operates as required to meet the requirements of this Section.
- C. Repair or replace any part of the system that fails to perform properly at no cost to the Owner.

#### 3.3 TRAINING:

- A. Provide Owner with manufacturer's operating instructions.
- B. Provide factory trained representatives to instruct the Owner's personnel in the operation of the system equipment.
- C. Demonstrate to Owner all system features and operations.

END OF SECTION

## SECTION 28 4600 – FIRE DETECTION AND ALARM

## PART 1 - GENERAL

## 1.1 SUMMARY:

## A. Section Includes:

1. Fire alarm system operation.
2. Fire alarm equipment.
3. Fire alarm wiring.

B. Design, furnish and install an integrated, analog and addressable, proprietary, monitoring and control system for a complete fire alarm system as described herein. The system includes processing units, local data panels, remote annunciators and peripheral alarm devices and outputs for specified control functions.

C. System includes, but is not limited to, controls, power supplies, signal initiating, ADA compliant strobe light units and sounding devices, modules, batteries, relays, conduit, annunciators, remote site digital dual phone line signal transmitters, wiring and other equipment necessary for a complete and operating system.

## D. Related Work:

1. Section 26 0000, Basic Electrical Requirements.
2. Section 26 0533, Raceways and Boxes for Electrical.
3. Section 26 2726, Wires, Cables and Connectors.

## E. Remodels - For remodels, or addition projects that require the expansion of the Fire Alarm System:

1. Provide the required additional panel enhancements, annunciator enhancements, additional devices to provide a complete addressable, programmed, and functional fire alarm system in compliance with these standards and applicable Codes, Ordinances, and the local AHJ.
2. Initiation devices minimum requirements:
  - a. Duct smoke detection sensors shall be addressable, photoelectric duct detectors with remote indicator and test key switch.
  - b. Test key switch should be ceiling or wall mounted in a public area as close as possible to where the duct detector is mounted.

## 1.2 SYSTEM DESCRIPTION:

A. Addressable system supervised 2-wire, Class B initiating and indicating circuits. Comply with requirements of Oregon Structural Specialty Code (OSSC), National Fire Protection Agency (NFPA), Oregon Fire Code (OFC) and the International Fire Code (IFC).

B. Power Requirements:

1. Provide the system with sufficient battery capacity to operate the entire system upon loss of normal 120VAC in a normal supervisory mode for a set period of time with alarm operation at the end of this period per owner requirements. The system shall automatically transfer to the standby batteries upon power failure. Provide automatic battery charging and recharging operation.
2. Provide circuits requiring system operating power at 24VDC and provide each circuit with individual fusing at the control panel.

1.3 SUBMITTALS:

- A. Submit shop drawings and product data in accordance with Division 1.
- B. A maximum of two submittal reviews will be performed by the Engineer. Compensate additional time and material to the Engineer based on their published fees for any additional reviews.
- C. Equipment submittals must include the following:
  1. Complete descriptive data (cut sheets and operation and maintenance manuals) including UL listing, FM approval (for the specified application) for all system components.
  2. Complete system wiring connection diagrams, wiring connection details (shop drawings).
  3. Indicate on floor plans device zone number and notification appliance circuit number.
  4. Show floor plans point to point wiring indicating the number, the gauge of the conductors and size of conduit/raceway used.
  5. Show a detailed riser diagram.
  6. Show an equipment block diagram indicating the number and gauge of the conductors used plus 20 percent spares.
  7. Show wiring connection details for components being connected to the system and interface to associated equipment.
  8. Provide control panel layout, battery calculations and graphs, voltage drop calculations (for each signaling circuit, door hold open/closer circuit indicating conductor run length and size). 5 percent voltage drop maximum.
  9. Show on floor plans symbol key with device catalog number, description, dimensions, back box size and mounting requirements.
  10. Complete sequence of operation.
  11. Indicate system components, size of components and location.
- D. Submit manufacturer's installation instructions.
- E. Submit manufacturer's descriptive literature, operating instructions and maintenance and repair data.

- F. Submit complete device and wiring diagrams on architectural sheets at original drawing scales with indication of device type, address and physical location, battery calculations, and component description to local fire AHJs, for approval, prior to construction.
- G. Submit, prior to final acceptance, a letter confirming that inspections have been completed and the system is installed and functioning in accordance with the Specifications. Include manufacturer representative's certification of installation and letter of warranty.
- H. Operation and Maintenance Manuals: Provide manuals containing professional developed Record Drawings, battery type and battery calculations, spare parts list, operating procedures, troubleshooting guide, program printout, data file on disk and a 1-year warranty agreement including parts and labor. Warranty period begins upon the date of final acceptance.

#### 1.4 QUALITY ASSURANCE:

- A. Requirements of Regulatory Agencies:
  - 1. Installation subject to inspection and approval of federal, state and local authorities.
  - 2. Equipment shall be UL listed and FM approved.
- B. Reference Standards:
  - 1. NFPA 72 - Adopted Edition.
  - 2. NEC - Adopted Edition.
  - 3. UBC - Adopted Edition and Oregon Amendments.
  - 4. NFPA 90A - Adopted Edition.
  - 5. NFPA 101 - Adopted Edition.
  - 6. UL UOJZ Listing.
  - 7. UL 1076 For Security.
  - 8. UFC - Adopted Edition

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS:

- A. Furnish all equipment specified in this Section by one manufacturer: Simplex, with no substitutions.

#### 2.2 INITIATING DEVICES:

- A. Manual Pull Stations: Semi-flush double action, color as approved by Architect and the AHJ. Stations do not allow closure without keyed reset. Provide each pull station with an addressable module.

- B. Fixed Temperature Heat Detectors: Rated 135 or 190F as noted on Drawings or required by space use. Provide off white low profile detectors with auxiliary contacts. Provide each device with an addressable module.
- C. Rate-of-Rise and Fixed Temperature Heat Detectors: Responding to 15 degree temperature rise per minute and to 135 degree fixed temperature as noted on Drawings or required by space use. Provide off white low profile detectors with auxiliary contacts. Provide each detector with an addressable module.
- D. Photoelectric Type Analog Detectors: Analog/addressable rate-compensating panel adjustable sensitivity with self compensating circuitry. Visual indication of detector actuation. LED source multiple cell. 360 degree smoke entry, functional test switch, 2-wire operation, 900 sq.ft. coverage, insect screen, vandal resistant locking feature. Auxiliary contacts rated of 1 amp at 24VDC resistive.
- E. Ionization Type Analog Detector: Analog/addressable dual chamber 360 degree smoke entry, visual latching operation indicator, insect screen, panel adjustable sensitivity, test switch, tamper resistant and solid state voltage regulation. Auxiliary contacts rated for 1 amp at 24VDC resistive.
- F. Duct-Mounted Analog Smoke Detectors: Analog/addressable ionization type, auxiliary relay contacts rated at 5 amp each at 120VAC. Duct sampling tubes extending width of duct, visual indication of detector actuation, 4-wire operation with direct housing mount. Detector powered from control panel, power on indicator light. Detector rated for air velocity and temperature of duct.

### 2.3 ANNUNCIATORS:

- A. Alphanumeric Remote Annunciator with Controls: Back lit LCD alphanumeric annunciator 80 characters long. Provide under locking cover a test switch, alarm and trouble buzzer, buzzer silence switch and buzzer silence message and reset switch, flush mount with finished cover, vandal-resistant UV stabilized Lexan (or approved) overlay and required modules, control panel, etc., to drive annunciator. Self-contained, suitable for wet location where located exterior. Verify location with AHJ before installation.
- B. Provide framed floor plan of facility adjacent to the annunciator panel identifying room names/numbers, device/addresses or fire zone number and listing as utilized on the annunciator panel. Check with the local fire department for size and approved mounting location.

### 2.4 BATTERIES AND CHARGING SYSTEM:

- A. Loss of normal and emergency power automatically cause the system to transfer to battery power. Indicate battery power operation by a yellow lamp and audible annunciation at the control panel, with sequential pulse signal. Upon return of the system power, unit recharges batteries to full capacity and maintain battery on float charge.

- B. Provide storage batteries of sufficient capacity to operate the fire alarm system under normal supervisory condition for District specified time frame and operate alarm signals for 15 minutes at the end of the standby period. Provide trickle charge adequate capacity to maintain the battery fully charged with automatic rate charge. Provide batteries, sealed gel cell type. Place batteries in a separate, locking cabinet manufactured for the purpose. Do not install cabinets or equipment below the battery cabinet. Do not locate battery and charging system cabinets in ceiling space.

## 2.5 INDICATING DEVICES:

- A. Audible/Visible Appliances (Horn/Strobes): Provide the horn-strobes with UL listing and meet the latest requirements of NFPA, ANSI and ADA. Candela rating 75 cd minimum unless otherwise indicated on Drawings.
- B. Visible Notification Appliances (Strobes): Flush wall mount. The strobes shall meet or exceed the latest requirements of NFPA 72, ANSI 117.1, and UL standard 1971. Candela rating 75 cd minimum unless otherwise indicated on Drawings.

## PART 3 - EXECUTION

### 3.1 INSTALLATION:

- A. Obtain approval of system design from fire authority prior to installation. Do not begin installation without approval from AHJ.
- B. Fire alarm conductor terminations in control panel and annunciator panels on terminal strips with separate point for each conductor number. Such strips identified as shown in wiring diagram attached to inside of door of control panel. Connect wiring neatly to terminal strips. Connect clip with nylon cable straps. Set up termination of cabling so that sections of the system may be isolated or shorted out for servicing. Maximum of two conductors under each terminal strip connection.
- C. From fire alarm control panel, make connection to motor controls and related equipment as required for fan system control. All relays shall be UL listed for the purpose used.
- D. Wiring:
  - 1. In accordance with manufacturer's instructions and as required by authorities, provide wiring, conduit and outlet boxes required for the erection of a complete system as described herein, as shown on Drawings, and as required by AHJ.
  - 2. Provide wiring to meet the requirements of national, state and local electrical codes. Provide color coded wiring as recommended and specified by the fire alarm and detection system manufacturer. Minimum wire size No. 14 or as approved by the Engineer. Test wiring free from ground faults and short circuits.

3. Provide Type FPL power-limited fire alarm cable when run in Wiremold (surface), Type FPLR power-limited fire alarm cable when run is from floor to floor or in a vertical run in a shaft (install metal raceways or rigid non metallic conduit where passing through a floor to a height of 7-feet above the floor) and Type FPLP power-limited cable when wiring is in ducts or plenum space.
4. Provide final connections between equipment and the wiring system approved by manufacturer.
5. Label devices as follows:
  - a. Initiating Devices (Circuit ID - Device Number) (M## - ##)
  - b. Notification Devices (Panel ID - NAC Circuit Number - Device Number) (P## - N## - ##)
  - c. Junction and Pull Boxes: legibly write on the cover with indelible ink pen the circuits contained in each box. Covers for all boxes containing fire alarm circuits shall be painted red.

### 3.2 FIELD QUALITY CONTROL:

- A. Upon completion of the installation, subject the system to operational tests and when necessary corrections have been accomplished, advise Architect who will schedule a final inspection test with the Owner. Ensure the connections to the fire alarm system have been in service for at least 10 days of trouble/alarm free operation prior to the final inspection. Furnish instruments, labor and materials required for the tests and a qualified technician to conduct the tests. Correct any deficiencies found at no cost and retest system as necessary, prior to final acceptance. Tests include the following:
  1. An operation of each signal initiating device (smoke detectors, heat detectors, pull stations, fire/smoke rated doors, process and facilities control sequences).
  2. An operation of each indicating device (alarm horn and alarm strobe).
  3. Operation of all features of the system under normal operation.
  4. Operation of all supervisory features of the system.
  5. Operation of all features of the systems on standby power with primary power off.
  6. Documentation by download of control panel memory.
- B. Upon completion of the installation of fire alarm equipment, provide to Architect a signed, written statement substantially in the form as follows: "The undersigned having been engaged as the Contractor on the facility confirms that the fire alarm equipment was installed in accordance with the Drawings, Specifications, wiring diagrams, instructions, directions provided by manufacturer, and requirements of the governing authorities."
- C. Provide a complete test of the system including all initiating devices and notification devices. Provide a written report of the testing. Provide any and all testing as required by the permitting jurisdiction.

3.3 EQUIPMENT DEMONSTRATION AND PERSONNEL TRAINING:

- A. At the direction of Architect, the equipment supplier of the system will provide factory trained representative to demonstrate the operation of the fire alarm system equipment and to instruct the Owner's personnel in its operation. Provide names and date of instruction prior to final acceptance.

3.4 OPERATION AND MAINTENANCE MANUALS:

- A. Provide three sets of manuals to the Architect prior to final acceptance. Provide manuals containing professional developed Record Drawings, battery type and battery calculations, spare parts list, operating procedures, troubleshooting guide, program printout, data file on disk and a one year warranty agreement including parts and labor. Warranty period begins upon the date of final acceptance.

END OF SECTION

## SECTION 312000 – EARTH MOVING

## PART 1 - GENERAL

## 1.1 CONTRACT CONDITIONS

- A. Work of this section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this specification and accompanying drawings.

## 1.2 SECTION INCLUDES

- A. Excavation and fills, including compaction, of on-site private pavement areas.

## 1.3 RELATED SECTIONS

- A. Section 312333 - Trenching and Backfill

## 1.4 REFERENCED SPECIFICATIONS

- A. ODOT Standard Specifications (latest revision).

## 1.5 DEFINITIONS

- A. Rock: Material that cannot be removed by one-yard shovel, by backhoe with 9,500 lb. digging force, by pick and shovel, or by 200 HP Crawler fitted with normal excavating equipment. Ripper attachment as might be hooked into seam is not considered "normal" excavating equipment.
- B. Unstable Soil: Soft, loose, wet, or disturbed ground that is incapable of supporting material, equipment, personnel, or structure.
- C. Wet Weather Conditions: Wet Weather Conditions apply to materials placed during dry weather but which are subsequently subjected to rainfall and equipment or construction traffic. The Contractor shall be responsible for the performance of the selected type of material.
- D. Large Woody Debris: Tree trunks over 8 inches in diameter and a minimum of 12 feet long (without root wads), cleaned to be free of weeds or weed seed by power washing subject to approval by Owner's Wetlands Consultant prior to installation in Wetland Mitigation Areas.

## 1.6 SUBMITTALS

- A. Comply with Section 013300, unless otherwise noted.
- B. Product Data: Manufacturer's specifications and technical data including performance, construction, and manufacturing information.

1. Submit for: Subgrade geotextile, crushed rock.
- C. Field Quality Control: Submittals as specified in Part 3 of this section.
  1. Field Tests.
  2. Special Inspections for Code Compliance.
- D. Closeout Requirements: Comply with Section 017700.
  1. Provide record documents.

#### 1.7 QUALITY REQUIREMENTS

- A. Manufacturer's Qualifications: Not less than 5 years of experience in the actual production of specified products.
- B. Installers Qualifications: Firm with not less than 5 years of experience in installation of systems similar in complexity to those required for this project.
- C. Product/Material Qualifications:
  1. Design Data: Compaction testing shall be in accordance with Section 014000, QUALITY REQUIREMENTS.
  2. Test Reports: Provide imported material gradation test reports. Provide material compaction test reports.
- D. Regulatory Requirements:
  1. An erosion control permit is not required. The contractor shall comply with the standard erosion control measures to insure the outcomes required by the Project Building Permit.
- E. Observation and Inspection: Owner will retain a Geotechnical Engineer to monitor earthwork operations.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, Storage and Protection: Comply with manufacturer's recommendations.
  1. Protect from damage by the elements and construction procedures.

#### 1.9 ADVANCE NOTICES

- A. Notify Engineer at least 48 hours before starting work of this section.

#### 1.10 COORDINATION

- A. Coordinate with other trades affecting or affected by work of this section.

**PART 2 - PRODUCTS****2.1 CRUSHED ROCK FILL AND PAVEMENT BASE**

- A. Imported clean 3/4" -0 or 1-1/2" - 0 crushed rock or crushed gravel, free from foreign material and conforming to the requirements of ODOT Standard Specification (latest revision) 02630.

**2.2 NATIVE MATERIAL**

- A. Excavated, on-site soil, native to project site, free of organics, solids larger than 3 inch diameter, weeds and other deleterious matter and approved by the Geotechnical Engineer for use as fill only during dry weather conditions.

**2.3 CONDUIT**

- A. Electrical conduit as specified in Division 26, ELECTRICAL.

**PART 3 - EXECUTION****3.1 EXISTING CONDITIONS**

- A. Prior to starting of the work of this section verify that existing grades and field conditions agree with drawings. Notify Engineer of deviations.
- B. Do not start work of this section until all unsatisfactory conditions have been corrected. Commencing work implies acceptance of existing conditions.
- C. If field measurements differ slightly from drawing dimensions, modify work as required for accurate fit. If measurements differ substantially, notify Engineer prior to starting work of this section.

**3.2 PROTECTION**

- A. Monuments: Carefully maintain benchmarks, monuments, and other reference points. If disturbed or destroyed, replace as directed.
- B. Existing Utilities: Existing utilities shall be field located. Protect active utility lines encountered. Repair or replace utility lines damaged by work of this Section.
- C. Pavement Cleaning: Maintain pavements and walkways clean at all times.
- D. Dust Control: Protect persons and property against damage and discomfort caused by dust; water as necessary and when directed.
- E. Other Work and Adjacent Property: Protect against damage caused by work of this section.

### 3.3 GENERAL REQUIREMENTS

- A. Contractor shall perform all excavation necessary or required for proper construction of the work and placement or installation of materials.
- B. Cutting Pavements: Cut vertical, straight-line joints using power saw designed for cutting pavements.
- C. Line and Grade: Excavate to lines and grades shown on the drawings or as established by the Engineer.
- D. Shoring: Shore excavations when necessary to prevent caving during excavation in unstable material, or to protect adjacent structures, property, workers, and the public or as required by local, state, or federal agencies. Shoring shall be removed, as the backfilling is done, in a manner that does not damage work or permit voids in the backfill. It shall be the sole responsibility of the Contractor to see that safety requirements are met.
- E. Temporary stockpiling of Excavated Materials: Excavated materials may be placed in approved areas. Do not obstruct roadways, bikeways, or pedestrian walkways. Conform to all federal, state and local codes governing the safe loading of excavated materials adjacent to excavations.
- F. Excess Excavation: Where excavation, through the Contractor's error, is carried to levels lower than those shown on drawings, backfill with specified bedding material to proper levels at Contractor's expense.
- G. Drainage: Except as otherwise permitted, excavation shall be done in a manner as to provide for adequate drainage. In excavation where gravity drainage is not practical, the Contractor shall provide pumps and accessories with which to remove and dispose of all water, including but not limited to, surface water from rainfall entering the excavations, as required to accomplish the work and as required by governing jurisdictions.
- H. Backfilling shall not commence until after excavations have been inspected. Backfill shall be placed in such a manner as not to disturb, damage, or subject such facilities to unbalanced loads or forces. Make fills as soon as feasible after Engineer's review and acceptance.
- I. If rock or unstable soil are encountered, notify Engineer. Removal of rock or unstable soil will be paid for as an addition to the contract.

### 3.4 CONSTRUCTION EROSION CONTROL

- A. Construction erosion control shall comply with the outcome requirements of the building permit. The contractor shall be responsible for monitoring the construction erosion control measures and shall make adjustments to measures in accordance with the drawings and permit to accommodate changes in earthwork operations and weather conditions.
- B. Upon completion of the project, remove all erosion control items from site.

### 3.5 CLEARING AND GRUBBING

- A. Clear and grub site in all areas to receive improvements. Clearing shall be the removal of all brush, grass, shrubs, trees, weeds, rubbish, structures, pavements, and debris flush with or slightly below original ground surface. Remove willow and blackberry, if any, to not less than 12 inches below original ground surface.
- B. Dispose of all cleared and grubbed materials off site.

### 3.6 EXCAVATION AND FILLS AT PAVEMENT AREAS

- A. Excavate existing material to the grades required on the drawings. Remove any additional excavated material from site.
- B. Use Crushed Rock Fill to raise the grade to the bottom of the pavement section elevation. Place fill in 6-inch maximum loose lifts and compact to a minimum density of 95 percent relative compaction, per a maximum dry density of ASTM D698 (latest revision) at an optimum moisture content of  $\pm 2$  percent. Fill that cannot be tested shall be compacted to the approval of the Geotechnical Engineer.

### 3.7 GRADING

- A. Perform all earthwork to the lines and grades shown on the drawings. Shape and finish slopes to conform to the lines, grades, and cross sections as shown or approved by the Engineer. Provide positive drainage away from buildings and sidewalks.

### 3.8 MAINTENANCE OF EARTHWORK

- A. Contractor shall maintain all earthwork surfaces until all work has been completed and accepted. Such maintenance shall include, but not be limited to, addition of appropriate backfill material to keep backfilled surface smooth, free from ruts and potholes, and suitable for traffic flow.

### 3.9 DISPOSAL OF WASTE MATERIAL AND EXCESS EXCAVATION

- A. Remove from site excess material that is unsuitable for backfilling or stockpiling at the Contractor's expense.

### 3.10 SETTLEMENT

- A. Any settlement in earthwork which occurs during the warranty period and is attributable to construction procedures, such as improper removal of shoring or insufficient compaction, shall be corrected by the Contractor at his own expense. Any piping or facilities damaged by such settlement shall be restored to their original condition at the Contractor's expense.

**3.11 FIELD QUALITY REQUIREMENTS**

- A. Refer to Section 014000 for responsibilities for arranging, supervising, and payment of field quality control requirements.
- B. Field Tests:
  - 1. Subgrade compaction testing.
  - 2. Material compaction testing.
  - 3. Imported material gradation testing.
- C. Field Inspections: Notify Engineer prior to work of this section.
- D. Special Inspections for Code Compliance: Obtain building inspector approvals.

**3.12 CLEANING**

- A. Upon completion of the work of this section promptly remove from the working area all scraps, debris, and surplus material.

**3.13 PROTECTION**

- A. Protect all work installed under this section.
- B. Replace at no additional cost to Owner, any damaged work of this Section.

END OF SECTION 312000

## SECTION 312333 - TRENCHING AND BACKFILL

## PART 1 - GENERAL

## 1.1 CONTRACT CONDITIONS

- A. Work of this section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this specification and accompanying drawings.

## 1.2 SECTION INCLUDES

- A. Excavation and fills, including compaction, of on-site private storm drain distribution systems.

## 1.3 RELATED SECTIONS

## 1.4 REFERENCED SPECIFICATIONS

- A. ODOT Standard Specifications (current edition).

## 1.5 DEFINITIONS

- A. Rock: Material that cannot be removed by one-yard shovel, by backhoe with 9,500 lb. digging force, by pick and shovel, or by 200 HP Crawler fitted with normal excavating equipment. Ripper attachment as might be hooked into seam is not considered "normal" excavating equipment.
- B. Unstable Soil: Soft, loose, wet, or disturbed ground that is incapable of supporting material, equipment, personnel, or structure.

## 1.6 SUBMITTALS

- A. Comply with Section 013300, unless otherwise indicated.
- B. Product Data: Manufacturer's specifications and technical data including performance, construction, and manufacturing information.
- C. Field Quality Control submittals as specified in Part 3 of this Section.
  - 1. Field Tests
  - 2. Special Inspections for Code Compliance

### 1.7 QUALITY REQUIREMENTS

- A. Manufacturer's Qualifications: Not less than 5 years of experience in the actual production of specified products.
- B. Installer's Qualifications: Firm with not less than 5 years of experience in installation of systems similar in complexity to those required for this project.
- C. Product/Material Qualifications:
  - 1. Design Data: Compaction testing shall be in accordance with Section 014000, QUALITY REQUIREMENTS.
  - 2. Test reports: Provide imported material gradation test reports. Provide material compaction test reports.

### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, Storage and Protection: Comply with manufacturer's recommendations.
  - 1. Protect from damage by the elements and construction procedures.

### 1.9 ADVANCE NOTICES

- A. Notify Engineer at least 48 hours before starting work of this section.

### 1.10 COORDINATION

- A. Coordinate with other trades affecting or affected by work of this section.

## PART 2 - PRODUCTS

### 2.1 CRUSHED ROCK

- A. Imported, clean, 3/4" - 0 crushed rock or crushed gravel, free from foreign material and meeting the requirements of ODOT Standard Specifications (current edition) 02630.
- B. To be used for Pipe Base Material, Pipe Zone Material, and Trench Backfill.

### 2.2 CONTROLLED DENSITY FILL

- A. Controlled Density Fill (CDF) shall be a mixture of cement, fly ash, aggregates, water and admixtures proportioned to provide a non-segregating, self-consolidating, free-flowing and excavatable material which will result in a hardened, dense, non-settling fill.
- B. Mix Design: Mix design shall conform to the following. The weights shown are only an estimate of the amount to be used per cubic yard of CDF. The actual amounts may vary from

those shown if approved by the Engineer. The Contractor shall submit additional data to be approved by the Engineer.

Proportions per Cubic Yard

Maximum Compressive Strength	100 - 250 p.s.i.
Maximum Mixing Water	30 - 50 gals.
Cement	30 - 50 lbs.
Fly Ash	200 - 350 lbs.
Dry Aggregate	2700 - 3200 lbs.

- C. CDF used to fill abandoned pipe: The Contractor shall submit certified engineering data, for the proposed mixture to be used, for the following:
1. 30 and 90-day unconfined compressive strength (C') tests as described in ASTM D4832 with the following exception: cylinders will not be capped.
  2. Yield and dry unit weight additional (ASTM D6103)
  3. Flowability (ASTM D6023)
  4. Removability (Removability Modules  $RE \leq 1.0$ )
  5. Mixture's components and sources (company and location). Previous test results, on the same mixtures using the same components, will satisfy this requirement.

### 2.3 DRAIN ROCK

- A. Imported, clean, 1/2" to 1-1/2" uncrushed, nearly round aggregate free from foreign material and meeting the requirements of ODOT Standard Specifications (current edition) 01090.12.

### 2.4 DRAINAGE GEOTEXTILE

- A. Non-woven geotextile; grab tensile strength 90 lb minimum per ASTM D4632 each direction; burst strength 185 psi minimum per ASTM D3786; puncture strength 55 lb minimum per ASTM D4833 or ASTM D3787 OSHD TM 816; No. 70 sieve or smaller opening per ASTM D4751; minimum 150 gal/min/ft<sup>2</sup>. Amoco 4545 or approved.

### 2.5 TRACER WIRE

- A. Electrically conductive tracer wire, 18 - gauge, insulated copper or heavier, green in color, or other approved material. To be placed full length of trench with non - metallic pipe.

## PART 3 - EXECUTION

### 3.1 EXISTING CONDITIONS

- A. Prior to starting work of this section, verify that existing grades and field conditions agree with drawings. Notify Engineer of deviations.

- B. Do not start work of this section until all unsatisfactory conditions have been corrected. Commencing work implies acceptance of existing conditions.
- C. If field measurements differ slightly from drawing dimensions, modify work as required for accurate fit. If measurements differ substantially, notify Engineer prior to starting work of this section.

### 3.2 PROTECTION

- A. Monuments: Carefully maintain bench marks, monuments, and other reference points. If disturbed or destroyed, replace as directed.
- B. Existing Utilities: Existing utilities shall be field located. Protect active utility lines encountered. Repair or replace utility lines damaged by work of this section.
- C. Pavement Cleaning: Maintain pavements and walkways clean at all times.
- D. Dust Control: Protect persons and property against damage and discomfort caused by dust; water as necessary and when directed.
- E. Other Work and Adjacent Property: Protect against damage caused by work of this section.

### 3.3 GENERAL REQUIREMENTS

- A. Contractor shall do all trenching and excavating necessary or required for proper construction of the work and placement or installation of materials. Tunneling or jacking shall not be used unless approved in writing by the Engineer.
- B. Cutting Pavements: Cut vertical, straight - line joints using power saw designed for cutting pavements. Cut minimum one foot beyond each side of trench.
- C. Obstructions: Remove all obstructions encountered within the trench area or adjacent thereto. If requested by Contractor, Engineer may make minor changes in trench alignment to avoid major obstructions, provided such alignment changes can be made without adversely affecting the intended function of the facility. Contractor shall pay any additional costs resulting from such alignment changes.
- D. Trenching: Minimum trench width to be 12 inches greater than outside diameter of pipe. Maximum trench width at top of trench shall not be limited except where excess width of excavation would cause damage or create damage to adjacent structures or facilities.
- E. Line and Grade: Excavate trench to lines and grades shown on the drawings or as established by the Engineer with proper allowances for pipe thickness and special bedding when required.
- F. Shoring: Shore trench when necessary to prevent caving during excavation in unstable material, or to protect adjacent structures, property, workers, and the public or as required by local, state, or federal agencies. Shoring shall be removed, as the backfilling is done, in a manner that will not damage pipe or permit voids in the backfill. It shall be the sole responsibility of the Contractor to see that safety requirements are met.

- G. Temporary Stockpiling of Excavated Material: Locate at least 2 feet from trench edges. Place excavated material only within approved areas. Do not obstruct roadways, bikeways, or pedestrian walkways. Conform to all federal, state and local codes governing the safe loading of excavated materials adjacent to trenches.
- H. Excess Excavation: Where excavation, through Contractor's error, is carried to levels lower than those shown on drawings, backfill with specified bedding material to proper levels at Contractor's expense.
- I. Drainage: At all times keep trenches dry. Provide and operate pumping equipment necessary to keep excavations free from standing water. Dispose of water in manner to prevent damage to adjacent property and as required by governing jurisdiction.
- J. If rock or unstable soil are encountered, notify Engineer. Removal of rock or unstable soil will be paid for as an addition to the contract.

### 3.4 EXCAVATION

- A. Excavate trenches to the line and grades shown on the drawings.

### 3.5 BACKFILL

- A. Backfilling shall not commence until after pipe, conduit, structures, and other equipment and appurtenances placed in trench or similar excavations have been properly constructed or installed, as applicable, and inspected. Backfill shall be placed in such a manner as not to disturb, damage, or subject such facilities to unbalanced loads or forces. Make fills as soon as feasible after Engineer's review and acceptance.
- B. Pipe Base: Place required thickness of Pipe Base Material over full width of trench. Provide uniform bearing under entire length of each pipe.
- C. Pipe Zone: Place required thickness of Pipe Zone Material over full width of trench.
- D. Above Pipe Zone: Backfill full width of trench to paving subgrade elevation or to within depth of loam in landscaped areas with Trench Backfill.
- E. Compaction: Trench backfill shall be compacted in maximum 12-inch lifts to:
  - 1. 95 percent compaction under pavement areas per ASTM D698 at an optimum moisture content of  $\pm 2$  percent.
  - 2. 90 percent compaction elsewhere per ASTM D698 at an optimum moisture content of  $\pm 2$  percent.
  - 3. Water settling of trench backfill will not be considered an acceptable compaction procedure.

### 3.6 MAINTENANCE OF TRENCH BACKFILL

- A. Contractor shall maintain all backfilled trench surfaces until all work has been completed and accepted. Such maintenance shall include, but not be limited to, addition of appropriate backfill

material above the pipe zone to keep backfilled trench surface smooth, free from ruts and potholes, and suitable for traffic flow.

### 3.7 ABANDONING PIPE IN PLACE (FOR UNDER AND WITHIN 2 FEET OF BUILDING)

- A. When required, all abandoned pipes shall be plugged at each end and filled with a controlled density fill (CDF). The CDF shall be pumped into each pipe segment from the downstream end. The material's flow characteristics will be such to allow free flow and total fill to pipe crown. If the pipe contains water, the CDF may be used to displace water.
- B. The CDF material shall be protected from freezing. Filling of each pipe segment shall be as continuous as possible.
- C. Field testing for flowability (ASTM D6023) each batch of CDF for a uniform 8- inch diameter spread or as approved by Engineer to achieve total pipe fill.
- D. Contractor shall monitor CDF filling to assure pipes are filled to the crown. Verification of total pipe fill to be submitted to Engineer. Verification procedure to be approved by Engineer prior to start of filling process.

### 3.8 DISPOSAL OF WASTE MATERIAL AND EXCESS EXCAVATION

- A. Remove from site excess material and that unsuitable for backfilling.

### 3.9 SETTLEMENT

- A. Any settlement in trench backfill which occurs during the warranty period and is attributable to construction procedures, such as improper removal of shoring or insufficient compaction, shall be corrected by the contractor at his own expense. Any piping or facilities damaged by such settlement shall be restored to their original condition at the Contractor's expense.

### 3.10 FIELD QUALITY REQUIREMENTS

- A. Refer to Section 014000 for responsibilities for arranging, supervising, and payment of field quality control requirements.
- B. Field Tests:
  - 1. Material compaction testing:
    - a. Trench Compaction: A minimum of one field density test shall be conducted on compacted material for every 100 linear feet, or fraction thereof, of trench and for every 3 feet, or fraction thereof, of fill placed.
  - 2. Imported material gradation testing.
- C. Field Inspections: Notify Engineer prior to work of this section.
- D. Special Inspections for Code Compliance: Obtain building inspector approvals.

3.11 CLEANING

- A. Upon completion of the work of this section promptly remove from the working area all scraps, debris, and surplus material.

3.12 PROTECTION

- A. Protect all work installed under this section.
- B. Replace, at no additional cost to Owner, any damaged work of this section.

END OF SECTION 312333

## SECTION 312500 - EROSION AND SEDIMENT CONTROL

## PART 1 - GENERAL

## 1.1 CONTRACT CONDITIONS

- A. Work of this section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this specification and accompanying drawings.

## 1.2 SECTION INCLUDES

- A. Prevention of erosion due to construction activities.
- B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
- C. Restoration of areas eroded due to insufficient preventative measures.
- D. Compensation of owner fines levied by authorities having jurisdiction due to non-compliance by contractor.

## 1.3 REFERENCED SPECIFICATIONS

- A. ODOT Standard Specifications (current edition).

## 1.4 SUBMITTALS

- A. Comply with Section 013300, unless otherwise noted.
- B. Product Data: Manufacturer's specifications and technical data including performance, construction, and manufacturing information.
  - 1. Submit for: None.
- C. Closeout Requirements: Comply with Section 017700.

## 1.5 QUALITY REQUIREMENTS

- A. All measures indicated in this specification may not be required. Contractor responsible for implementing erosion and sediment controls adequate to comply with permit requirements.
- B. Manufacturer's Qualifications: Not less than 5 years of experience in the actual production of specified products.
- C. Installers Qualifications: Firm with not less than 5 years of experience in installation of systems similar in complexity to those required for this project.

- D. Regulatory Requirements:
1. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained.
  2. An erosion control permit is not required. The contractor shall comply with the building permit.
  3. Owner will withhold payment to Contractor equivalent to all fines resulting from non-compliance with applicable regulations.
- E. Stormwater Runoff: Control increased stormwater runoff due to disturbance of surface cover due to construction activities for this project.
1. Prevent runoff into storm sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
  2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.
- F. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
1. Control movement of sediment and soil from temporary stockpiles of soil.
  2. Prevent development of ruts due to equipment and vehicular traffic.
  3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- G. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
1. Prevent windblown soil from leaving the project site.
  2. Prevent tracking of mud onto public roads outside site.
  3. Prevent mud and sediment from flowing onto sidewalks and pavements.
  4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- H. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways and storm sewers.
1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments and relocate on site; comply with requirements of authorities having jurisdiction.
- I. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments and relocate on site; comply with requirements of authorities having jurisdiction.
- J. Open Water: Prevent standing water that could become stagnant.
- K. Monitoring and Inspection:

1. Contractor shall be responsible for monitoring the construction erosion control measures and shall make adjustments to measures, in accordance with the drawings and building permit, to accommodate changes in earthwork operations and weather conditions.
2. Contractor shall be responsible for appointing an Erosion Control Inspector. Inspector shall be a person knowledgeable in the principles and practice of erosion and sediment controls, who possesses the skills to assess conditions at the construction site that could impact stormwater quality, is knowledgeable in the correct installation of the erosion and sediment controls, and is able to assess the effectiveness of any sediment and erosion control measures selected to control the quality of stormwater discharges from the construction activity. Erosion Control Inspector shall submit periodic inspection reports as noted on the Drawings.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, Storage and Protection: Comply with manufacturer's recommendations.
  1. Protect from damage by the elements and construction procedures.

#### 1.7 ADVANCE NOTICES

- A. Notify Engineer at least 48 hours before starting work of this section.

#### 1.8 COORDINATION

- A. Coordinate with other trades affecting or affected by work of this section.

### PART 2 - PRODUCTS

#### 2.1 BARK/MULCH BIO BERM

- A. The compost filter berm material consists of compost or a blend of compost and mulch materials according to the specifications as follows.
- B. The filter berm material shall meet particle sizing specifications that when used in a filter berm system are tested in conformance with the outlined methods and scope of ASTM D6459 (latest revision), standard test method for determination of Erosion Controlled Blanket (ECB) Performance in Protecting Hill Slopes from Rainfall Erosion.
- C. The compost portion of the filter berm shall be derived from well-decomposed organic matter source produced by controlled aerobic (biological) decomposition that has been sanitized through the generation of heat and stabilized to the point that it is appropriate for this particular application. Compost material shall be processed through proper thermophilic composting, meeting the U.S. Environmental Protection Agency's definition for a 'process to further reduce pathogens' (PFRP). The compost portion shall meet the chemical, physical and biological properties outlined below.
  1. The pH shall be between 5.0 and 8.5 for berms to receive vegetation.

2. Nitrogen Content: 0.5 - 2.0%.
3. Soluble Salts: Maximum 5 mmhos/cm.
4. Compost shall be weed and pesticide free, with manmade materials comprising less than 1%.

## 2.2 SEDIMENT FENCE

- A. Sediment Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths.
- B. Apparent Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D4751 (latest revision).
- C. Permittivity:  $0.05 \text{ sec}^{-1}$ , minimum, when tested in accordance with ASTM D4491 (latest revision).
- D. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355 (latest revision) after 500 hours exposure.
- E. Grab Tensile Strength-Supported: 100 lb-f, minimum, in cross-machine direction; 120 lb-f, minimum, in machine direction; when tested in accordance with ASTM D4632 (latest revision).
- F. Grab Tensile Strength-Unsupported: 90 lb-f, minimum, in cross-machine direction; 100 lb-f, minimum, in machine direction; when tested in accordance with ASTM D4632 (latest revision).
- G. Color: Manufacturer's standard, with embedment and fastener lines preprinted.
- H. Manufacturers:
  1. BP Amoco, Amoco Fabrics and Fibers; [www.geotextile.com](http://www.geotextile.com).
  2. TC Mirafi; [www.tcmirafi.com](http://www.tcmirafi.com).
  3. Synthetic Industries; [www.fixsoil.com](http://www.fixsoil.com).

## 2.3 BIO-FILTER BAGS

- A. Provide minimum size 18" x 6" x 30" plastic mesh bags with 1/2 inch openings filled with approximately 45 pounds of clean, 100% recycled wood-product waste.

## 2.4 CATCH BASIN INSERT BAG / CURB INLET SEDIMENT DAM

- A. Provide prefabricated filter inserts manufactured specifically for collecting sediment in drainage inlets. Include handles and/or fasteners sufficient to keep the insert from falling into the inlet during maintenance and removal of the insert from the inlet. Insert bags shall be included on the Oregon Qualified Products List (QPL) for Type 3 Inlet Protection, or approved. Curb Inlet Sediment Dams shall be included on the Oregon QPL for Type 6 Inlet Protection, or approved.

## PART 3 - EXECUTION

### 3.1 EXISTING CONDITIONS

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.
- B. Do not start work of this section until all unsatisfactory conditions have been corrected. Commencing work implies acceptance of existing conditions.
- C. If field measurements differ slightly from drawing dimensions, modify work as required for accurate fit. If measurements differ substantially, notify Engineer prior to starting work of this section.

### 3.2 INSTALLATION OF EROSION AND SEDIMENT CONTROL MEASURES

- A. Install as shown on drawings, or as directed by Engineer, Erosion and Sediment Control Inspector, or Local Authority Having Jurisdiction. All measures included in this specification or details shown on Drawings may not be necessary. Contractor to utilize measures, as needed, to meet the requirements of erosion control permit(s) and the intent of this specification.

### 3.3 PROTECTION

- A. Monuments: Carefully maintain bench marks, monuments, and other reference points. If disturbed or destroyed, replace as directed.
- B. Existing Utilities: Existing utilities shall be field located. Protect active utility lines encountered. Repair or replace utility lines damaged by work of this Section.
- C. Pavement Cleaning: Maintain pavements and walkways clean at all times.
- D. Dust Control: Protect persons and property against damage and discomfort caused by dust; water as necessary and when directed.
- E. Other Work and Adjacent Property: Protect against damage caused by work of this section.

### 3.4 FIELD QUALITY REQUIREMENTS

- A. Refer to Section 014000 for responsibilities for arranging, supervising, and payment of field quality control requirements.
- B. Special Inspections for Code Compliance:
  - 1. Obtain building approvals from Local Authority Having Jurisdiction.
  - 2. Provide periodic inspection reports as noted on the Drawings.

## 3.5 MAINTENANCE

- A. Maintain temporary measures until permanent measures have been established.
- B. Repair deficiencies immediately.

## 3.6 CLEANING

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Engineer.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.
- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

## 3.7 PROTECTION

- A. Protect all work installed under this section.
- B. Replace at no additional cost to Owner, any damaged work of this Section.

END OF SECTION 312500

## SECTION 321200 - FLEXIBLE PAVING

## PART 1 - GENERAL

## 1.1 CONTRACT CONDITIONS

- A. Work of this section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this specification and accompanying drawings.

## 1.2 SECTION INCLUDES

- A. Asphaltic concrete pavements and crushed rock pavement base, for on-site private improvements.

## 1.3 REFERENCED SPECIFICATIONS

- A. 2018 Oregon Standard Specifications for Construction, HMAC Pavement Reference, Section 00744.

## 1.4 SUBMITTALS

- A. Comply with Section 013300, unless otherwise indicated.
- B. Product Data: Manufacturer's specifications and technical data including performance, construction, and fabrication information.
  - 1. Submit for job mix formulas (JMF).
- C. Field Quality Control submittals as specified in Part 3 of this Section:
  - 1. Field Tests.
- D. Closeout Requirements: Comply with Section 017700.
  - 1. Special warranties
  - 2. Provide record documents.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Not less than 5 years of experience in the actual production of specified products.
- B. Installer's Qualifications: Firm with not less than 5 years of experience in installation of systems similar in complexity to those required for this project.

- C. Pre-installation Conference: Contractor, installer, Engineer, and representatives of other affected trades shall meet at site to review paving operations, acceptance of substrata surfaces, and coordination with other trades.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, Storage and Protection: Comply with manufacturer's recommendations.
  - 1. Protect materials and maintain product temperature during delivery.

1.7 SPECIAL WARRANTIES

- A. Contractor shall warrant installed pavement for a period of 2 years from date of Substantial Completion. When notified in writing from Owner, they shall promptly and without inconvenience and cost to Owner correct said deficiencies to comply with requirements.

1.8 COORDINATION

- A. Coordinate with other trades affecting or affected by work of this section.

1.9 ADVANCE NOTICES

- A. Notify Engineer at least 48 hours before starting work of this section at each site.

PART 2 - PRODUCTS

2.1 CRUSHED ROCK PAVEMENT BASE

- A. Under Dense Graded HMAC Mixture: Imported Clean 3/4"-0 or 1-1/2"-0 dense graded crushed rock or crushed gravel, free of foreign material and meeting the requirements of ODOT Standard Specifications (current edition) 02630, Base Aggregate.

2.2 HOT MIXED ASPHALT CONCRETE (HMAC)

- A. Asphalt Mixture: The asphalt concrete mixture shall be a well-graded, uniform coated, durable mix of the mix type(s) as shown on the plans or approved by the Engineer.

BROADBAND LIMITS

DENSE GRADED MIXTURE

Sieve Size Passing	Percentage of Total Aggregate (by weight) 1/2" Dense	Percentage of Total Aggregate (by weight) 3/4" Dense
1"	--	99-100

3/4"	99-100	92-100
1/2"	90-100	75-91
1/4"	52-80	50-70
No. 10	21-46	21-41
No. 40	8-25	6-24
No. 200	3-8	2-7
Asphalt Cement	4-8	4-8

- B. Asphalt Cement (Binder): Per Oregon Standard Specifications for Construction, (current edition). Use PG (Performance Grade) 64-22 for base and wearing courses.
- C. Aggregate for Base Course Mix: Per Oregon Standard Specifications for Construction (current edition).
- D. Aggregate for Wearing Course (Top Lift of HMAC) Mix: Per Oregon Standard Specifications for Construction (current edition).
- E. Fine Aggregate: Per Oregon Standard Specifications for Construction (current edition).
- F. Mineral Filler: Finely ground particles of limestone, hydrated lime, or other mineral dust, free of foreign matter.
- G. Asphalt Tack Coat: Type CSS-1, CSS-1h, CMS-2, CMS-2S, CMS-2h, CRS-2, HFRS-2 or HFMS-2 emulsified asphalt (EA) conforming to Standard Specifications for Highway Construction (current edition).
- H. Reclaimed Asphalt Pavement (RAP) Material: Shall not exceed 30% in the new pavement. Rap material not permitted in open graded or Level 4 HMAC pavement, in accordance with Standard Specifications for Highway Construction (current edition). Asphalt mixtures including RAP to meet all normal specification and Oregon Standard Specifications for Construction (current edition) requirements.

### 2.3 JOB MIX FORMULA (JMF)

- A. Mix Formula: The Contractor shall submit a JMF for each mixture to be used on the project and meeting the Level 2 criteria of Oregon Standard Specifications for Construction, Current Edition.
- B. The Contractor shall supply the job mix design to the Engineer ten (10) work days prior to production. The job mix formula shall be no more than five (5) years old.
- C. Approval: No paving shall occur until the Contractor receives written approval of the Contractor's job mix formula.

### 2.4 HMAC ACCEPTANCE

- A. The mixture will be accepted by visual inspection of the Engineer. If the mixture is considered suspect, the Contractor shall obtain samples under the observation of the Engineer and tested as per Oregon Standard Specifications for Construction, Current Edition (section 00744.16). Testing shall be performed by an independent testing agency paid for by the Contractor.

Contractor to be reimbursed by Owner if testing shows HMAC is within the specified limits and tolerances.

## 2.5 HMAC PRODUCTION QUALITY CONTROL/ASSURANCE

- A. As specified for Level 2 HMAC in the Oregon Standard Specifications for Construction, Current Edition. Submit the appropriate documentation/reports to Engineer for review.

## 2.6 MODIFICATION OF MIXES

- A. Modification: The Engineer reserves the right to modify specified mixes for use under various traffic conditions on various segments of the work and for feathering, spot patching, and other special purposes. The Contractor shall provide mixes proportioned as directed by the Engineer for such purposes.

## 2.7 PAVEMENT MARKINGS

- A. Traffic paint shall be Contractor Grade alkyd, white traffic marking paint, unless otherwise noted on drawings, two (2) coats, 8.0 mil minimum dry film thickness, Ennis pain, or approved equal with approval by the District.

## PART 3 - EXECUTION

### 3.1 EXISTING CONDITIONS

- A. Prior to starting of the work of the section verify that existing grades and field conditions agree with drawings. Notify Engineer of deviations.
- B. Do not start work of this section until all unsatisfactory conditions have been corrected. Commencing work implies acceptance of existing conditions.
- C. If field measurements differ slightly from drawing dimensions, modify work as required for accurate fit. If measurements differ substantially, notify Engineer prior to starting work of this section.

### 3.2 WEATHER LIMITATIONS

- A. Surface Temperature: Asphalt concrete shall be placed on a dry prepared surface when the surface temperature is not less than specified below.

Nominal Specified  
Compacted Thickness  
of Individual Courses  
2" to 2-1/2"      50°F  
2-1/2" and over   40°F

- B. Weather: Asphalt concrete shall not be placed during rain or other adverse weather conditions. However, if approved by the Engineer, the mix in transit at the time the adverse conditions occur may be laid if the mix has been covered during transit and is at the specified temperature, if the foundation is free from pools or flow of water, and if all other requirements of these specifications are met. Asphalt concrete mixtures shall not be placed when the foundation is frozen or when, in the opinion of the Engineer, existing or expected weather conditions will prevent the proper handling, finishing, or compaction of the mixtures. Dense and open graded mixes shall only be placed from 3/15 – 9/30.
- C. Ambient Temperature Caution: The Contractor is cautioned that placing asphalt concrete on cool days when the temperature is less than 60°F may require an adjustment in Contractor's normal placing and compaction procedures so that specified minimum compaction requirements will be met. The temperatures shown in the table in this section are not recommended temperatures for paving, but paving may be allowed at these temperatures on the condition that specified pavement compaction is achieved.

### 3.3 ASPHALT CONCRETE PAVING MACHINE

- A. Pavers: Pavers shall be self-contained, power-propelled units with an activated screed or strike-off assembly, heated if necessary, and capable of spreading and finishing layers of asphalt concrete material to the widths thicknesses, lines, grades, and cross sections required.

### 3.4 COMPACTORS

- A. Rollers: Rollers shall be steel wheel, pneumatic tire, vibratory or a combination of these types. They shall be in good condition and capable of reversing without backlash.

### 3.5 PREPARATION OF FOUNDATION

- A. Bases: All bases and foundations on which the pavement is to be constructed shall meet the applicable specifications and be approved prior to the start of paving. Existing bases and foundations shall be reconditioned as specified or directed.
- B. Edges: Broken or ragged edges of existing paved surfaces underlying or abutting the new pavement shall be trimmed back to firm material. Surfaces against which asphalt concrete is to be placed shall be treated with an asphalt tack coat.
- C. Tack Coat: Prior to placing each lift of asphalt concrete, tack coat asphalt shall be applied to completely cover all cold longitudinal joint and all prepared existing asphalt and portland cement concrete surfaces. Immediately before applying the tack coat, the surface to be tacked shall be clean and dry. The application rate shall be between 0.05 and 0.20 gallons per square yard of surface area to achieve uniform, thorough coverage and as approved by the Engineer. Emulsified asphalt temperature to be between 140 and 185°F and application to be in accordance with manufacturer's recommendations.

### 3.6 CRUSHED ROCK PAVEMENT BASE PLACEMENT

- A. Placement and compaction shall conform to the requirements of Section 312000, Earth Moving.

### 3.7 PLACING ASPHALT PAVEMENT - SINGLE COURSE

- A. Place asphalt within 24 hours of applying tack coat. Do not place HMAC pavement on the tack coat until the asphalt separates from the water (breaks), but before it loses its tackiness.
- B. Place up to 3 inch compacted thickness in one lift.
- C. Install drainage covers and frames in correct position and elevation.
- D. Compact pavement by rolling. Do not displace or extrude pavement from position. Use hand-operated compacting equipment in areas inaccessible to rolling equipment.
- E. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks.

### 3.8 CONTROL OF LINE AND GRADE

- A. Line and Grade: The Contractor shall furnish, place, and maintain supports, wires, devices, and materials as necessary to provide continuous line and grade reference control to the automatic paver control system on either or both sides of the paving machine.

### 3.9 HAULING, DEPOSITING AND PLACING

- A. Hauling: Cover HMAC if rain or cold air temperatures are encountered any time between loading and placement. Engineer may reject material compromised (below specified temperature, slumping or separating, solidifying or crusting). Rejected loads will be disposed of off-site at the Contractor's expense.
- B. Depositing: Material shall be deposited from vehicles to prevent segregation.
- C. Placing: Do not place material during rain or other adverse weather conditions, unless allowed by Engineer. Material placed in adverse conditions is to meet all normal contract specification requirements. Material in transit at the time adverse conditions occur may be placed if it has been covered during transport, it is placed in areas free of standing or flowing water, temperature and all other requirements are met.

### 3.10 TEMPERATURE CONTROL

- A. Temperature of Mixture:
  - 1. The temperature of the mixture at the time it is placed in final position shall be within 10 degrees of 280°F. The Engineer may adjust the lay-down temperature in 10-degree increments to attain maximum workability and compaction. In no case shall the lay-down temperature of mixture be less than 240°F.

### 3.11 COMPACTION

- A. Rolling: Immediately after the asphalt concrete mixture has been spread, struck off and surface irregularities and other defects remedied, it shall be thoroughly and uniformly rolled until the

mixture is compacted. Complete breakdown and intermediate compaction before the mix temperature drops below 180°F.

B. General:

1. The type, number, and weight of rollers shall be sufficient to compact the mixture while it is still within the specified temperature range. Rollers shall not be operated in vibratory mode when the temperature of the mixture has dropped below 180 degrees.
2. Steel roller wheels shall be moistened with water or other approved material to the least extent necessary to prevent pickup of mixture and not cause spotting or defacement of the surface of the mixture.
3. Rollers shall be operated at speeds recommended by the roller manufacturer and slow enough to avoid displacement of the mixture. The maximum speeds shall be 3 miles per hour for steel-wheeled rollers and pneumatic-tired rollers, unless faster speeds are approved.
4. Care shall be exercised not to displace the line and grade of edges. Displacement of any course occurring as a result of the reversing of the direction of a roller, or from other causes, shall be corrected at once by the use of approved rakes and addition of fresh mixture when required.
5. Any mixture that becomes loose and broken, contaminated, segregated, or is in any way defective, shall be removed and replaced with new mixture at no expense to the Owner.
6. Finish rolling shall continue until all roller marks are eliminated.
7. Along curbs and walls, on walks, irregular areas, and other areas not practicably accessible to specified rollers, the mixture shall be compacted with approved self-propelled rollers, mechanical tampers, hot hand tampers, or heavy hand rollers. On depressed areas, a trench roller may be used or cleated compression strips may be used under the roller to transmit compression to the depressed area.

C. Density Requirements:

1. The Contractor is responsible for process control and shall conduct sampling, testing, measurement and inspection. The contractor shall provide daily nuclear density testing (ODOT Test Method 310C-87) to develop rolling patterns necessary to achieve the minimum compaction requirement of 91 percent as determined by Rice Density Test AASHTO T 209 as modified by ODOT TM 306. This is in addition to Owner's testing as necessary to ensure the finished pavement meets specifications. A copy of all compaction test reports shall be provided to the Engineer. Contractor to immediately take corrective measures when it is determined that specified compaction density is not achieved. If specified compaction density cannot be achieved the Contractor shall remove and replace the defective asphalt areas at the Contractor's expense. The Owner has the option of accepting these areas with a reduced payment to the Contractor.
2. Asphalt compaction below 88 percent as determined by Rice Density Test AASHTO T 209 as modified by ODOT TM 306 is not acceptable.
3. The Architect will determine the suitability of the final product through final acceptance testing. Results of these tests will be used to determine payment deductions, if any to be assessed against the Contract. The final density of each paving project location will be determined by averaging the results of a minimum of five (5) density tests taken with a nuclear gauge (ODOT TM 310C-87) at randomly selected locations within each paving project.
4. Paving in areas 6 feet wide or less and irregular areas not accessible by large rollers are not subject to the minimum compaction per (2) above.

5. The Owner shall take acceptance tests to verify that the work meets specifications.

### 3.12 PAVEMENT SMOOTHNESS

- A. Utility Structures: The joint between the pavement and the top surface of utility structures, such as manhole covers and valve boxes located in the traveled way, shall meet the pavement surface tolerances.
- B. Tolerance: The surface of the finished pavement shall be within 0.02 foot of the specified line, grade, and cross section.
- C. Texture: The completed surface of all courses of the mixture shall closely parallel that specified for the top surface of the finished pavement and shall be smooth, uniform on texture and conform to the specified crown and grade.
- D. Job control testing shall be performed with a 10 foot straightedge furnished and operated by the Contractor. The Engineer may observe this testing, or the Engineer may require additional testing to be performed under the Engineer's supervision. Operations to eliminate the unacceptable pavement shall be corrected by the Contractor using a method or methods listed below and approved by the Engineer.
- E. Roughness: When tests show the pavement is not within the above tolerances, the Contractor shall take immediate action to correct equipment or procedures in the paving operations to eliminate the unacceptable pavement roughness.
- F. Method of Correction: Any surface irregularities exceeding the above tolerances shall be corrected by the Contractor using a method or methods listed below and approved by the Engineer.

### 3.13 FIELD QUALITY REQUIREMENTS

- A. Refer to Section 014000 for responsibilities for arranging, supervising, and payment of field quality control requirements.
- B. Field Tests:
  1. Base rock compaction testing.
  2. Asphaltic concrete pavement compaction testing.
  3. Asphaltic concrete pavement gradation testing.
- C. Field Inspections: Notify Engineer prior to paving operations.

### 3.14 STRUCTURE ADJUSTMENT

- A. Prior to placement of wearing course, locate and adjust to finished pavement grade all catch basins and other structures and appurtenances within the pavement area.

## 3.15 PAVEMENT STRIPING

- A. All areas to be marked shall be cleaned to insure proper bonding. Cleaning shall consist of flushing and sweeping plus a detergent cleaning of oil spills. Sweeping shall be completed no more than eight (8) hours prior to application of markings.
- B. A minimum of 14 days cure time is required prior to paint application, for any new paint placed on new asphalt or concrete pavement.

## 3.16 CLEANING

- A. Trim and remove excess asphalt concrete accumulations from abutting structures such as curbs, manholes, catch basins, and other structure.
- B. Including work of other sections, clean, repair and touch-up, or replace when directed, products which have been soiled, discolored, or damaged by work of this section. Remove excess spilled material and debris from project site upon work completion or sooner, if directed.
- C. Upon completion of the work of this section promptly remove from the working area all scraps, debris, and surplus material.

## 3.17 PROTECTION

- A. In addition to other required provisions for traffic, the following shall apply to pavement construction: No traffic or equipment shall come in contact with the compacted mixture until it has cooled and set sufficiently to prevent marking; edges shall be protected from being broken down; and edge drop-off(s) one inch or more in height shall be marked with approved reflectorized and/or flashing warning devices visible by day and night to the traveling public, and placed at spacings as specified by the Engineer.
- B. Protect all work installed under this section.
- C. Replace at no additional cost to Owner, any damaged work of this section.

END OF SECTION 321200

**SECTION 321600 - CONCRETE CURBS, GUTTERS AND WALKS****PART 1 - GENERAL****1.1 CONTRACT CONDITIONS**

- A. Work of this section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this specification and accompanying drawings.

**1.2 SECTION INCLUDES**

- A. On-site private curb, walks and pavement improvements.

**1.3 RELATED SECTIONS**

- A. Section 033000 - Cast-In-Place Concrete
- B. Section 312000 - Earth Moving

**1.4 DESIGN AND ENGINEERING**

- A. Formwork design and engineering, as well as construction, are the sole responsibility of the Contractor.

**1.5 SUBMITTALS**

- A. Comply with Section 013300, unless otherwise indicated.
- B. Quality Control:
  - 1. Submit joint layout drawings for Engineer's review and acceptance.
- C. Closeout Requirements: Comply with Section 017700.
  - 1. Provide record documents.

**1.6 WEATHER PRECAUTIONS**

- A. Provide cold weather and/or hot weather protection as recommended in ACI 306 and ACI 305.
- B. Unless adequate protection is provided, concrete shall not be placed during rain, sleet, or snow. Protect concrete from rain water, maintain concrete water ratio and protect concrete surface.

- C. All concrete shall be adequately protected after pouring to prevent damage from freezing, by the use of suitable cover. Frozen and damaged concrete must be removed and replaced at the Contractor's expense. Do not place concrete on frozen earth.

#### 1.7 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Not less than 5 years of experience in the actual production of specified products.
- B. Installers Qualifications: Firm with not less than 5 years of experience in installation of systems similar in complexity to those required for this project.
- C. Product/Material Qualifications:
  - 1. Design data: Compaction testing shall be in accordance with Section 014000, QUALITY REQUIREMENTS.
  - 2. Test reports: Provide job mix test reports.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Delivery, Storage and Protection: Comply with manufacturer's recommendations.
  - 1. Protect from damage by the elements and construction procedures.

#### 1.9 ADVANCE NOTICES

- A. Notify Engineer at least 48 hours before intended concrete placement.
- B. Place no concrete until formwork and reinforcement have been inspected.

#### 1.10 COORDINATION

- A. Coordinate with other trades affecting or affected by work of this section.

### PART 2 - PRODUCTS

#### 2.1 CRUSHED ROCK PAVEMENT BASE

- A. Imported, clean, 3/4"-0 Crushed Rock Pavement Base as specified in Section 312000, EARTH MOVING.

#### 2.2 CAST-IN-PLACE CONCRETE

- A. Concrete shall be ready-mixed conforming to Section 033000, CAST-IN-PLACE CONCRETE, and shall have a minimum compressive strength of 3,000 psi at 28 days.

### 2.3 FORMS

- A. Conform to Section 033000, CAST-IN-PLACE CONCRETE.

### 2.4 REINFORCEMENT

- A. Conform to Section 033000, CAST-IN-PLACE CONCRETE.
- B. Provide where shown on drawings.

### 2.5 CURING COMPOUND

- A. Curing compound for all other concrete shall conform to AASHTO M171, White Polyethylene Film for curing concrete or AASHTO M148, Liquid Membrane-Forming Compounds for Curing Concrete.

## PART 3 - EXECUTION

### 3.1 EXISTING CONDITIONS

- A. Prior to starting work of this section verify that existing grades and field conditions agree with drawings. Notify Engineer of deviations.
- B. Do not start work of this section until all unsatisfactory conditions have been corrected. Commencing work implies acceptance of existing conditions.
- C. If field measurements differ slightly from drawing dimensions, modify work as required for accurate fit. If measurements differ substantially, notify Engineer prior to starting work of this section.

### 3.2 EXCAVATION

- A. All excavation shall be in accordance with Section 312000, EARTH MOVING.

### 3.3 CRUSHED ROCK BASE

- A. After the subgrade is compacted and at the proper grade, spread required thickness of 3/4-inch minus crushed rock. Compact by rolling or other approved method. Surface of the compacted base shall be at the proper level to receive the concrete. Manholes, catch basins, inlets, and other such structures shall be completed, adjusted, cured, and otherwise prepared, as applicable, and made clean and ready to have concrete placed in contact with them.

### 3.4 FORMWORK

- A. Conform to the requirements of Section 033000, CAST-IN-PLACE CONCRETE. Construct forms to the shape, lines, grades, and dimensions called for on the Drawings. Stake wood or

steel forms securely in place, true to line and grade. Brace forms to prevent change of shape of movement in any direction resulting from the weight of the concrete during placement.

- B. Allowable Tolerances: Tops of forms shall not depart from grade line more than 1/8-inch when checked with 10-foot straightedge. Alignment of straight sections shall not vary more than 1/8-inch in 10 feet.

### 3.5 REINFORCEMENT

- A. Reinforcement shall conform to the requirements of Section 033000, CAST-IN-PLACE CONCRETE. Provision shall be made for placing dowels, tie bars, and other devices called for by the Contract Documents, during placement of the pavement. Reinforcement shall be placed on supporting devices, or "chairs," and maintained in position while the pavement is being placed.

### 3.6 FINISHING

- A. After the pavement has been struck off and consolidated, it shall be scraped with a straightedge equipped with a handle to permit operation from the edge of the pavement. Any excess water shall be removed from the surface of the pavement. Irregularities shall be corrected by adding or removing concrete. All disturbed places shall be again straight-edged.
- B. After the concrete has been given a preliminary finish, the surface of the pavement shall be checked by the contractor with a straightedge device. Each successive check with the straightedge device shall lap the previous check path by at least half the length of the straightedge. Surface deviations exceeding 0.01 foot shall be corrected. Upon completion of the surface floating, but before any required edge tooling or joint tooling, and before initial set of the surface pavement, the pavement shall be given a textured finish perpendicular to match the existing. The textured finish shall be accomplished by a steel tine tool that will mark the finished pavement to a depth of 1/8 inch plus or minus 1/16 of an inch. Match finish of existing pavement where new pavement is adjacent. The surface of the pavement shall not vary from a true surface, when tested with a 12 foot testing straightedge, more than 1/8 inch in 12 feet.
- C. Finish shall be a light broom finish for slip resistant surface. Broom pattern to be parallel to slope.
- D. Accessible Ramps: Steel trowel finish. Apply tactile warning finish.

### 3.7 JOINTS

- A. Construction joints, expansion joints, transverse contraction joints, and all longitudinal contraction joints shall be placed as indicated in the drawings.
- B. Contraction Joints:
  - 1. Longitudinal contraction joints shall consist of planes of weakness created by forming grooves in the surface of the pavement.
  - 2. Maximum joint spacing shall be 5 feet for sidewalks, and as shown on drawings for other work.

- C. Construction Joints: Construction joints shall be placed whenever the placing of concrete is suspended for more than 45 minutes. A butt joint with dowels or a thickened-edge joint shall be used if the joint occurs at the location of a contraction joint.

### 3.8 SEALING JOINTS

- A. Seal joints for curbs, gutters, and walks in conformance with 033000, CAST-IN-PLACE CONCRETE.
- B. Saw cut sealant reservoir for pavement joints using a double cut per the details shown on the construction drawings. Clean reservoir, prepare joints, install backer rod and sealant all in strict accordance with the recommendations in the joint sealant manufacturer's installation or application guide and in accordance with the appendix to ASTM D5893 (latest revision) (if using silicone sealant).
- C. Joints to be sealed shall be filled with joint-sealing material before the pavement is opened to traffic and as soon after completion of the curing period as is feasible.
- D. Each joint shall be thoroughly cleaned of all foreign material, including membrane curing compound, and joint faces shall be clean and surface-dry when seal is applied.

### 3.9 WALK EDGING

- A. Before final finishing is completed and before final concrete set has occurred, finish concrete edges with edging tool shaped with 1/4 inch radius.
  - 1. Take particular care to maintain surface on both sides of joint in same plane.
  - 2. Do not use kneeling planks on concrete surface.

### 3.10 CURING

- A. Minimum Curing Period: 3 days.
- B. Uniformly apply compound in accordance with manufacturer's instructions, after final Concrete finishing is complete, and after all free water has disappeared from pavement surface.
- C. Apply to concrete edges immediately after formwork removal.
- D. Do not use membrane compound method if pavement will be exposed to de-icing chemicals within 30 days following curing period completion.

### 3.11 FIELD QUALITY REQUIREMENTS

- A. Refer to Section 014000 for responsibilities for arranging, supervising, and payment of field quality control requirements.
- B. Field Tests:
  - 1. Observance and approval of subgrade and base rock compaction.

2. Concrete cylinder strength tests. Concrete flexural strength tests.
3. Slump and air tests.

- C. Field Inspections: Notify Engineer prior to work of this section.
- D. Special Inspections for Code Compliance: Obtain building inspector approvals.

### 3.12 DEFECTIVE WORK

- A. Remove and replace any surfaces which show excessive cracks, pavements that do not drain properly, and other defective concrete.
- B. Minimum Surface Evenness: 1/8 inch per 10 ft.

### 3.13 CLEANING

- A. Including work of other trades, clean, repair and touch-up, or replace when directed products which have been soiled, discolored, or damaged by work of this section.
- B. Upon completion of the work of this section, promptly remove from the working area all scraps, debris, and surplus material.

### 3.14 PROTECTING COMPLETED WORK

- A. Protect all work installed under this section.
- B. Replace, at no additional cost to Owner, any damaged work of this section.

END OF SECTION 321600

## SECTION 323113 - CHAIN LINK FENCES AND GATES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes chain-link fences and swing gates.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Product Certificates: For each type of chain-link fence and gate, from manufacturer.
- D. Product Test Reports: For framing strength according to ASTM F 1043.
- E. Operation and maintenance data.
- F. Sample of special warranty.

#### 1.3 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 2. Warranty Period: Five years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
  - 1. Fabric Height: Six feet.
  - 2. Steel Wire Fabric: Wire with a diameter of 0.120 inch (3.05 mm).
    - a. Mesh Size: 2 inches (50 mm).

- b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. (366 g/sq. m) with zinc coating applied before weaving.
3. See notes on plans for tighter mesh at new gate and adjacent fence panels
4. Selvage: Twisted top and knuckled bottom.

## 2.2 FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:
  1. Fence Height: 72 inches (1830 mm).
  2. Heavy Industrial Strength: Material Group IA, round steel pipe, Schedule 40.
    - a. Line Post: 2.875 inches (73 mm) in diameter.
    - b. End, Corner and Pull Post: 4.0 inches (102 mm) in diameter.
  3. Horizontal Framework Members: Intermediate, top and bottom rails complying with ASTM F 1043.
  4. Brace Rails: Comply with ASTM F 1043.

## 2.3 TENSION WIRE

- A. Metallic-Coated Steel Wire: 0.177-inch- (4.5-mm-) diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824, with the following metallic coating:
  1. Type II, zinc coated with minimum coating weight matching chain-link fabric coating weight.

## 2.4 SWING GATES

- A. General: Comply with ASTM F 900 for gate posts and single swing gate types.
  1. Gate Leaf Width: 48 inches.
  2. Gate Fabric Height: 72 inches (1830 mm).
- B. Pipe and Tubing:
  1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.
  2. Gate Posts: Round tubular steel.
  3. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Welded.
- D. Hardware:

1. Hinges:
  - a. 180-degree outward swing.
  - b. Brass pin bullet hinges
2. Latches permitting operation from both sides of gate
3. Panic hardware: Manufacturer's standard with c-channel protection
4. Lock: Manufacturer's standard
5. Closer: Manufacturer's standard. Spring hinges are not permitted.

## 2.5 FITTINGS

A. General: Comply with ASTM F 626.

B. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. (366 g /sq. m) zinc.
2. Aluminum: Mill finish.

## 2.6 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Align new fencing with existing fence locations and limits.
- B. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.
- C. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- D. Post Setting: Set posts in concrete into firm, undisturbed soil.
  1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
  2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
    - a. Exposed Concrete: Extend 2 inches (50 mm) above grade; shape and smooth to shed water.

- E. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 30 degrees or more.
- F. Line Posts: Space line posts uniformly at maximum 96 inches (2440 mm) o.c.
- G. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Provide horizontal tension wire at the following locations:
  - 1. Extended along top and bottom of fence fabric.
- H. Chain-Link Fabric: Apply fabric to inside of enclosing framework. Leave 1 inch (25.4 mm) between finish grade or surface and bottom selvage unless otherwise indicated.
- I. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
- J. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

END OF SECTION 323113

## SECTION 334000 - STORM DRAINAGE UTILITIES

## PART 1 - GENERAL

## 1.1 CONTRACT CONDITIONS

- A. Work of this section is bound by the Contract Conditions and Division 1, bound herewith, in addition to this specification and accompanying drawings.

## 1.2 SECTION INCLUDES

- A. On-site private storm drain system improvements.

## 1.3 RELATED SECTIONS

- A. Section 312333 - Trenching and Backfill

## 1.4 SUBMITTALS

- A. Comply with Section 013300, unless otherwise indicated.
- B. Product Data: Manufacturer's specifications and technical data including performance, construction, fabrication, and installation information.
  - 1. Submit for: pipe and fittings.
- C. Field Quality Control submittals as specified in Part 3 of this Section:
  - 1. Field Tests
  - 2. Special Inspections for Code Compliance
- D. Closeout Requirements: Comply with Section 017700.
  - 1. Provide record documents.

## 1.5 QUALITY REQUIREMENTS

- A. Manufacturer's Qualifications: Not less than 5 years of experience in the actual production of specified products.
- B. Installer's Qualifications: Firm with not less than 5 years of experience in installation of systems similar in complexity to those required for this project.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping: Deliver products in original, unopened packing with legible manufacturer's identification.
- B. Storage and Protection: Comply with manufacturer's recommendations.
  - 1. Protect from damage by the elements and construction procedures.

## 1.7 ADVANCE NOTICES

- A. Notify Engineer at least 48 hours before starting work of this section.

## 1.8 COORDINATION

- A. Coordinate with other trades affecting or affected by work of this section.

## PART 2 - PRODUCTS

## 2.1 STORM PIPE AND FITTINGS (DUCTILE IRON) (BUILDING APPROVED MATERIAL, FOR USE UNDER AND WITHIN 2 FEET OF BUILDING)

- A. Shall be cement-lined ductile iron pipe, Class 52, conforming to AWWA C151. Fittings shall be Class 52, conforming to AWWA C153 for mechanical joints pressure rating of 350 psi and AWWA C110 for flange joints pressure rating of 250 psi. Provide with manufactured fittings unless otherwise noted on drawings.
- B. Provide pipe wrap, 8 mil polywrap meeting pipe manufacturer's recommendations.

## 2.2 STORM PIPE AND FITTINGS (BUILDING APPROVED MATERIAL, FOR USE UNDER AND WITHIN 2 FEET OF BUILDING)

- A. Any of the following pipe materials may be used (with solvent cement joints).
  - 1. PVC DWV, ASTM D26652 (latest revision).
  - 2. ABS Schedule 40/DWV, ASTM D2661 (latest revision).
  - 3. PVC Schedule 40/DWV Cellular Core Pipe, ASTM F891 (latest revision).
  - 4. PVC Schedule 40, ASTM D1785 (latest revision).
- B. Provide with manufactured fittings unless otherwise noted on drawings.

## 2.3 PERFORATED PIPE AND FITTINGS (SCHEDULE 40, FOR USE UNDER AND WITHIN 2 FEET OF BUILDINGS)

- A. Any of the following pipe materials may be used (with solvent cement joints).
  - 1. PVC DWV, ASTM D2665 (latest revision).

2. ABS Schedule 40/DWV, ASTM D2661 (latest revision).
3. PVC Schedule 40/DWV Cellular Core Pipe, ASTM F891 (latest revision).
4. PVC Schedule 40, ASTM D1785 (latest revision).

- B. Provide with manufactured fittings unless otherwise noted on drawings.
- C. Pipe perforations to be in accordance with ASTM D3034 (latest revision) perforation requirements. Post-manufacturing perforations are acceptable.
- D. Provide with machine-knitted polyester drain envelope, 100-135 burst strength. Equivalent opening size of 30 to 40.

#### 2.4 FLEX-TRANSITION COUPLER

- A. Shall be Fernco, 1000 series. Use fittings manufactured for the specific pipe size and material types being connected.

#### 2.5 RIGID TRANSITION COUPLINGS

- A. Ductile iron to PVC pipe connections to be "501-H" coupling by Romac Industries, Inc..

#### 2.6 SADDLE CONNECTION

- A. Shall be "CB" sewer saddle by Romac Industries, Inc.

#### 2.7 CONCRETE

- A. Concrete shall be ready-mixed conforming to Section 033000, CAST-IN-PLACE CONCRETE, and shall have a compressive strength of 3,000 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches.

#### 2.8 OTHER MATERIALS

- A. Recommended by Manufacturer and subject to Engineer's review and acceptance. Provide all materials required to complete and make drainage system operational.

### PART 3 - EXECUTION

#### 3.1 EXISTING CONDITIONS

- A. Prior to starting work of this section, carefully inspect trench, excavations, and pipe bedding to verify that all such work is complete to the point where this installation may properly commence.
- B. Do not install work of this section until unsatisfactory conditions have been corrected. Commencing work implies acceptance of existing conditions.

- C. If field measurements differ slightly from drawing dimensions, modify work as required for accurate fit. If measurements differ substantially, notify Engineer prior to starting work of this section.

### 3.2 TRENCHING AND BACKFILL

- A. Trenching and backfill shall conform to the requirements of Section 312333, TRENCHING AND BACKFILL.

### 3.3 PIPE INSTALLATION

- A. Installation shall be in accordance with the manufacturer's recommendation. All pipe ends and interiors shall be thoroughly cleaned of all foreign matter and shall be kept clean during installation. When work is not in progress, all open ends of pipe and fittings shall be securely closed so that no water, earth, animal life, or other substance may enter.
- B. Cutting pipe shall be done in a neat and workmanlike manner by method which will not damage pipe and as recommended by manufacturer.
- C. Install piping within 0.02 foot of indicated grade and location.
- D. All ductile iron pipe joints and fitting joints within 5 feet of building and beneath building shall be fully covered with asphaltic coating. Wrap ductile iron pipe and fittings within 5 feet of building and beneath building with Polywrap.

### 3.4 FIELD QUALITY REQUIREMENTS

- A. Refer to Section 014000 for responsibilities for arranging, supervising, and payment of field quality control requirements.
- B. Field Tests:
  - 1. Deflection Test:
    - a. Conduct deflection tests of flexible pipe. The testing shall be conducted by pulling an approved mandrel through the completed pipeline. The diameter of the mandrel shall be 95 percent of the pipe initial inside diameter. Conduct testing on a manhole-to-manhole basis after flushing and cleaning.
    - b. The mandrel shall be pulled in front of the camera so the deflection testing is clearly recorded on the video tape unless approved by the Engineer.
    - c. A water depth gauge shall be provided, located on the TV camera side of the mandrel. The gauge shall be graduated with marks at 0.50" increments clearly visible during TV inspection. The gauge shall be capable of measuring depth of water in 0.50" increments from 0.50" to 2.5". The gauge shall be designed so it will remain plumb regardless of the rotation of the mandrel or camera.
    - d. Deflection testing shall be conducted and accepted prior to any paving being done.
- C. Field Inspections: Notify Engineer prior to work of this section.

- D. Special Inspections for Code Compliance: Obtain plumbing inspector approvals.

### 3.5 CLEANING

- A. Prior to final acceptance, Contractor shall flush and clean all elements of the completed system. All pipe and structures shall be clean and free of all construction debris, rocks, gravel, mud, sand, silt, and other foreign material, and as directed by the Engineer.
- B. Upon completion of work of this section promptly remove from the working area all scraps, debris, and surplus material.

### 3.6 PROTECTION

- A. Protect all work installed under this section.
- B. Replace, at no additional cost to Owner, any damaged work of this section.

END OF SECTION 334000