

Oregon Manufacturing Innovation Center R&D  
33701 Charles T Parker Way,  
Scappoose OR 97056

Additive Manufacturing Innovation Center

PROJECT MANUAL

**DRAFT**

Aug 05, 2021

Project #1503

**AKAAN** Architecture + Design LLC  
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503-366-3050

**DRAFT**

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This Project Manual has been organized under the format of the Construction Specifications Institute (CSI). Section numbers are listed merely for identification and they may not be consecutive. The Contractor shall check the contents of this Manual against this Table of Contents to assure that this volume is complete.

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Owner Provided

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**1.1 WORK COVERED BY CONTRACT DOCUMENTS**

- A. Work of this Contract comprises the construction of a new Manufacturing and Research Building as follows:
1. Stories: 1
  2. Approximate Floor Area: 30,000 sq. ft.
  3. Location: Scappoose, Oregon

**1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS**

- A. Base Bid & Alternate Bids: Section 01-20-00

**1.3 OWNER-CONTRACTOR AGREEMENT**

- A. See Contract Conditions

**1.4 WORK BY OTHERS UNDER SEPARATE CONTRACT**

- A. Concurrently with Work of this Contract:
1. Security System Work
  2. Cable TV System Work
  3. Internet Technology (IT) Work

**1.5 WORK PERFORMED BY OWNER**

- A. Concurrently with Work of this Contract:
1. Products furnished by Owner for installation by Contractor (OFCI):
    - a. Equipment where indicated on Drawings as OFCI
    - b. Any other Work identified on Drawings as OFCI
      1. Installation Procedures: See Section 11-00-50
  2. Products furnished and installed by Owner (OFOI):
    - a. Telephones
    - b. Furniture
    - c. Equipment not included in this Contract
    - d. Any other Work identified on Drawings as OFOI

(Cont.)

**1.6 OWNER'S USE OF PREMISES**

- A. Owner will occupy adjacent Premises during construction period for the conduct of Owner's normal operations.
- B. Cooperate with Owner during construction operations to minimize conflicts and to facilitate Owner's use of facilities.
- C. Schedule Work to maintain Owner's continuous operations. Include in Contract Sum sufficient funds as may be required for any "overtime" work caused by this requirement. No additional payment to Contractor will be authorized because of Contractor's failure to anticipate required "overtime" work.

**1.7 CONTRACTOR'S USE OF PREMISES**

- A. Contractor shall limit Contractor's use of the Premises for work and storage to allow for:
  - 1. Work by other Contractors
  - 2. Owner's occupancy of adjacent Premises
- B. Coordinate use of Premises as directed by Architect.

**1.8 OVERTIME WORK**

- A. To permit arrangements for inspections, the Contractor shall notify the Architect at least 48 hours in advance of any overtime work, including nights, weekends, and holidays. Do no overtime work, requiring inspections, without notifying Architect.
- B. The Contractor shall reimburse the Architect and Owner for any expenses incurred by them because of Contractor's overtime work.

**1.9 WORK WITHIN PUBLIC RIGHT-OF-WAY**

- A. The Contractor shall obtain any required Right-Of-Way Work Permits, pay Permit Fees, and comply with governing Regulatory Agency requirements, including providing any additional Insurance required by Public Authority.

(Cont.)



### **1.10 PRODUCTS FURNISHED BY OWNER & INSTALLED BY CONTRACTOR**

**A. Owner's Responsibilities:**

1. In compliance with approved Construction Progress Schedule:
  - a. Arrange for and deliver necessary Shop Drawings, Product Data, and Samples to Contractor.
  - b. Arrange and pay for Product delivery to Site.
  - c. Deliver Supplier's Bill of Materials to Contractor.
  - d. Inspect Product deliveries jointly with Contractor.
  - e. Submit claims for transportation damage.
  - f. Arrange for replacement of damaged, defective, missing, or otherwise unacceptable Items.
  - g. Arrange for required Manufacturer's inspections, service, bonds, and warranties.

**B. Contractor's Responsibilities:**

1. Designate in Construction Schedule delivery date for each Product.
2. Review Shop Drawings, Product Data, and Samples. Notify Architect about any discrepancies or problems anticipated in Product installation or use.
3. Receive Product and unload at Project Site.
4. Promptly inspect Product jointly with Owner. Record any damage, shortage, or defect.
5. Protect Products against damage and discoloration.
6. Assemble, install, connect, adjust, and finish Products as stipulated in respective Specification Sections.
7. Lawfully dispose of Shipping Containers and Packaging Waste.
8. Clean, repair and touch-up, or replace when directed, Products which have been soiled, discolored, or damaged by Contractor.

### **1.11 PROTECTING EXISTING UTILITIES**

- A.** Drawings indicate approximate location of any known, concealed Utility Lines. Before starting work, Contractor shall determine exact location of any of these Lines that could be damaged by Contract Work.
- B.** Contractor shall assume that other unknown Utility Lines do exist, and Contractor shall proceed with caution when working in areas that could conceal unknown Utilities. If such Utility Lines are encountered, immediately request disposition instructions from Architect.
- C.** If Utility Lines are damaged: Remove, repair, or replace Lines as directed. Additional compensation and/or extensions of time, if any, caused by removing, repairing, or replacing Lines will be determined in accordance with General Conditions.

### **1.12 USE OF OWNER'S PROPERTY & EQUIPMENT**

- A.** Do not use Owner's Property, Facilities, or Equipment such as Tools, Ladders, Furniture, Janitorial Equipment, Supplies, etc.

**1.13 OFFENSIVE ODORS**

- A. Do not permit Vehicle Exhaust Fumes to accumulate, such as Fumes caused by idling trucks or other combustion engines.
- B. Do not use offensive smelling Compounds. When such Odors are unavoidable, exhaust Odors directly to out-of-doors.

**1.14 DISTURBING NEIGHBORS**

- A.
- B. Do not disturb Neighbors or park Vehicles, Material, or Equipment in front of Neighboring Properties without Neighbors' prior-approval.

**1.15 INAPPROPRIATE BEHAVIOR**

- A. Use of offensive language or gestures (including display of suggestive photos and calendars); sexual or racial harassment; insubordination to Owner's Personnel, their Design Consultants, or their Guests will not be tolerated. Those who behave inappropriately will be banned from Project Site, and no increase in Contract Sum or extension of Contract Time will be authorized for such banning.

**1.16 FIRE-HAZARDOUS WORK**

- A. Perform no Welding, Torch-cutting, Soldering, Brazing, or other hazardous Work which could activate existing Fire or Smoke Detectors without the following:
  - 1. Give Owner's Representative 48 hours advance notice of such Work.
  - 2. Maintain adequate Fire Extinguishing Equipment close at hand during such Work.

**1.17 SHUTDOWN OF EXISTING UTILITIES**

- A. Do not interrupt existing Utility Services without advance written approval of Owner's Representative.
- B. Minimum Advance Notice:
  - 1. For Minor Interruptions: 3 working days
  - 2. For Major Interruptions impacting entire Building, Wing, or Floor: 10 working days

(Cont.)

### **1.18 RESPONSE TIME FOR CORRECTING NON-COMPLYING WORK**

- A. Contractor's response to notice of Work to be Corrected shall be accomplished during the following time periods:
1. Emergency Work:
    - a. Failures or deficiencies constituting immediate danger or health hazard to People or likely damage to Property.
    - b. Response Time: 24 hours per day, 7 days per week and within 2 hours following receipt of Notice
  2. Urgent Work:
    - a. Failures or deficiencies which do not immediately endanger Persons or Property, but would soon do so if not corrected.
    - b. Response Time: Between 7:00 AM & 4:00 PM on Mondays through Fridays and within 3 calendar days following receipt of Notice.
  3. Routine Work:
    - a. Failures or deficiencies of less importance that do not meet criteria of Emergency or Urgent Work.
    - b. Response Time: Between 7:00 AM & 4:00 PM on Mondays through Fridays and within 5 calendar days following receipt of Notice.

### **1.19 SPECIFICATIONS DIVISION, SECTION, & PARAGRAPH NUMBERING**

- A. Numbering or lettering of Divisions, Sections, and Paragraphs in the Specifications Are merely for identification and may not be consecutive.
- B.. The Divisions and Sections included are listed in the Table of Contents. The Contractor shall verify that the Contractor's copies of the Project Manual are complete.

### **1.20 SPECIFICATIONS WORDING**

- A. The Specifications are of an abbreviated or streamlined type and they frequently include incomplete sentences. Words and phrases such as "shall", "shall be", "Contractor shall"; and similar mandatory phrases shall be supplied by inference in same manner as they are in a note on the Drawings. The Contractor shall provide all Items listed and perform all operations required, in accordance with the General Conditions, if and as modified in these Specifications.

(Cont.)

## 1.21 SPECIFICATIONS DEFINITIONS

- A. **"Directed", "Requested", "Approved", "Authorized", "Selected", "Required", and "Permitted"** mean directed by the Architect, requested by the Architect, etc.
- B. **"Furnish"** means to supply and deliver to the Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.
- C. **"Indicated"** means references to graphic representations; notes or schedules on the Drawings, or other paragraphs or schedules in the Specifications; and similar requirements in the Contract Documents. Terms such as "shown", "noted", "scheduled", and "specified" are used to help the User locate the Reference.
- D. **"Install"** means operations at the Project Site including actual unloading, temporary storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- E. **"OFOI" (Owner Furnished & Owner Installed)** means Product in question will be furnished and installed by the Owner. The Contractor shall verify all requirements affecting Contractor's Work.
- F. **"OFCI" (Owner Furnished & Contractor Installed)** means Product in question will be furnished by the Owner, and installed by the Contractor. The Contractor shall verify all requirements affecting Contractor's Work.
- G. Where words **"or approved"** are used, the Architect is sole judge of quality and suitability of proposed substitution.
- H. **"Product"** includes Materials, Systems, and Equipment.
- I. **"Project Manual"** means a volume assembled for the Work which may include the Bidding Requirements, Sample Forms, Conditions of the Contract, Specifications, Detail Drawings, and Schedules.
- J. **"Project Site"** means space available to Contractor for performing Work activities, either exclusively or in conjunction with others performing other work as part of the Project.
- K. **"Provide"** means "furnish, install, and where appropriate connect ready for the intended use.
- L. **"Regulations"** mean laws, ordinances, statutes, and lawful orders issued by Authorities having jurisdiction, as well as rules, conventions, and agreements within the Construction Industry that control performance of the Work.

END OF SECTION

## **1.1 GENERAL**

- A. Certain Work Components of this Project have not been designed, engineered, or detailed by the Architect or the Architect's Consultants, and the Components must be designed, engineered, fabricated, and built by the Contractor.
- B. Design-Build Components are defined as either or both of the following:
  - 1. Complete and operational Systems that perform their intended use.
  - 2. Structural Elements which will be subject to Lateral or Vertical Loads.
- C. The Contractor shall coordinate and assume (or assign to Subcontractor) complete responsibility for design, engineering, submittals, fabrication, transportation, and installation of this Work.
- D. Prior to starting Work, the Contractor shall submit all Design-Build documents to the governing Building Department for review and approval. Each Design-Build item may require a separate Permit and Fee, which shall be paid by the Contractor when so required.

## **1.2 DESIGN-BUILD COMPONENTS OF THE WORK**

- A. Requiring Building Department review and approval:
  - 1. Metal Wall & Roof Panels: Section 07-41-00
  - 2. Phenolic Wall Panels: Section 07-43-00
  - 3. Firestopping: Section 07-84-00
  - 4. Aluminum Entrance & Window Wall Systems: Section 08-40-00
  - 5. Plastic Skylights: Section 08-62-00
  - 6. Translucent Sandwich Panels: Section 08-64-00
  - 7. Polycarbonate Plastic Skylights: Section 08-65-00
  - 8. Ceiling Suspension Systems: Section 09-10-00 & 09-50-00
  - 9. Factory-engineered Building: Section 13-12-10
  - 10. Fire Suppression Work: See Fire Suppression Specifications
  - 11. Other Design-Build Work specified elsewhere in Project Manual, if any.

## **1.3 DESIGN-BUILD DOCUMENT SUBMITTALS**

- A. To Architect:
  - 1. Prior to submitting Design Bid Documents to Building Department, submit Documents for Architect's review and approval similar to Shop Drawing Submittal Requirements specified in Section 01-33-00.
- B. To Building Department:
  - 1. Submit after receiving Architect's approval.
  - 2. Comply with Building Department requirements.
  - 3. Include design criteria, design assumptions, structural calculations, fabrication and construction details, required clearances, and interface requirements.
  - 4. Affix Design Professional's seal of Oregon State License on all Submittals.
  - 5. Submittals shall be timely and complete so that time required for Building Department's review will not affect Construction Progress Schedule.

**1.4 OWNER'S RESPONSIBILITIES**

- A. The Owner will not pay for progress delays, additional Work, additional products, restocking, or reworking required by Contractor's failure to coordinate Design-Build Work with other Project Work.

**END OF SECTION**

**1.1 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS**

- A. Submission & Acceptance of Bids: See Procurement Requirements
- B. Owner-Contractor Agreement Form: See Contract Requirements
- C. Summary of Work: Section 01-11-00

**1.2 BASE BID**

- A. Includes all Work shown on Drawings or included in Specifications, excepting only that Work noted in the following Alternate Bids, and that Work specifically noted as excepted.

**1.3 ALTERNATE BIDS**

- A. The following Alternate Bids are each identified by number and each describes basic changes to be incorporated into the Work, only when that Alternate is made part of the Work by specific provision in the Owner-Contractor Agreement.
- B. Referenced Specification Sections stipulate pertinent requirements for Products and methods to achieve the Work stipulated in the Alternate.
- C. Coordinate related Work and modify surrounding Work as required to integrate the Work of the Alternate, and to provide complete construction required by Contract Documents.
- D. **Alternate Bid No. 1:**
  - 1. Delete Operable Sun Shades specified in Section 10-71-00.
- E. **Alternate Bid No. 2:**
  - 1. Delete Canopy Roof shown on Drawings
- F. **Alternate Bid No. 3:**
  - 1. Delete Operable Partitions specified in Section 10-71-00.
- G. **Alternate Bid No. 4:**
  - 1. Delete Saw-tooth Roof Structure as shown on Drawings.
- H. **Alternate Bid No. 5:**
  - 1. Delete all other Skylights shown on Drawings.
- I. **Alternate Bid No. 6:**
  - 1. In lieu of Shop Building Mechanical Equipment Screens specified in Section 05-70-00, substitute Chain Link Fencing specified in Section 02-82-00
- J. **Alternate Bid No. 7:**
  - 1. \_\_\_\_\_
- K. **Alternate Bid No. 8:**
  - 1. \_\_\_\_\_
- L. **Alternate Bid No. 9:**
  - 1. \_\_\_\_\_

**END OF SECTION**

## **1.1 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS**

- A. Summary of Work: Section 01-11-00
- B. Project Meetings: Section 01-31-50
- C. Progress Schedules: Section 01-32-00
- D. Shop Drawings, Product Data, & Samples: Section 01-33-00
- E. Temporary Facilities: Section 01-50-00
- F. Cutting & Patching: Section 01-73-00
- G. Cleaning: Section 01-74-00
- H. Contract Closeout: Section 01-77-00

## **1.2 CONSTRUCTION ORGANIZATION & START-UP**

- A. Establish on-site Lines of Authority and Communications including the following:
  - 1. Preconstruction Meeting and Progress Meetings as specified in Section 01-31-50.
  - 2. Establish procedures for Intra-project Communications including:
    - a. Submittals
    - b. Reports & Records
    - c. Recommendations
    - d. Coordination Drawings
    - e. Schedules
    - f. Resolution of Conflicts
  - 3. Contract Documents Interpretation:
    - a. Consult with Architect to obtain interpretation
    - b. Assist in resolution of questions or conflicts which may arise
    - c. Transmit written interpretations to Subcontractors and to other concerned parties
  - 4. Permits & Approvals:
    - a. Verify that Subcontractors have obtained required Permits and Inspections for Work and for Temporary Facilities.
  - 5. Control use of Site:
    - a. Supervise Field Engineering and Project Layout.
    - b. Allocate Field Office Space and Work and Storage Areas for use of each Subcontractor.

## **1.3 COORDINATING SUBCONTRACTORS' WORK**

- A. Coordinate the Work of all Subcontractors and make certain that, where the Work of one Trade is dependent upon the Work of another Trade, the Work first installed is properly placed, installed, aligned, and finished as specified or required to properly receive subsequent Materials applied or attached thereto.
- B. Direct Subcontractors to correct defects in Substrates they install when Subcontractors of subsequent Materials have a reasonable and justifiable objection to such surfaces.
- C. Do not permit Subcontractors to apply or install Product over improperly installed or improperly finished Substrate that would result in an unsatisfactory or unacceptable finished Product.



#### **1.4 COORDINATING WORK WITH OWNER'S WORK**

- A. Coordinate, and make certain that, where Work of either party is dependent upon the other party, the Work first performed is properly placed, installed, aligned, and finished as required to permit the proper installation of the following Work.
- B. If the Owner's Work in any way interferes with the Contractor's Work, so notify the Owner sufficiently in advance so that the Owner has reasonable time to make necessary adjustments.
- C. If the Contractor's Work in any way interferes with the Owner's Work, so notify the Owner as soon as possible. If the Contractor's Work must be modified to accommodate the Owner's Work, the Contract Sum and/or the Contract Time will, when necessary, be adjusted by a Change Order.

#### **1.5 COORDINATING WORK WITH OTHER CONTRACTORS' WORK**

- A. Coordinate, and make certain that, where Work of either party is dependent upon the other party, the Work first performed is properly placed, installed, aligned, and finished as required to permit the proper installation of the following Work.
- B. If Other Contractors' Work in any way interferes with this Contractor's Work, so notify Owner's Representative sufficiently in advance so that the Owner has reasonable time to make necessary adjustments.
- C. If this Contractor's Work in any way interferes with Other Contractors' Work, so notify Owner's Representative as soon as possible. If this Contractor's Work must be modified to accommodate Other Contractors' Work, the Contract Sum and/or the Contract Time will, when necessary, be adjusted by a Change Order.

#### **1.6 CLOSE-OUT DUTIES**

- A. Equipment start-up:
  - 1. Comply with requirements specified in Section 01-75-00.
- B. At completion of Work of each Subcontract, conduct inspection to assure that:
  - 1. Work is acceptable.
  - 2. Specified cleaning has been accomplished.
  - 3. Temporary Facilities and Debris have been removed from Site.
- C. Substantial Completion:
  - 1. Conduct inspection and prepare list of Work to be completed or corrected.
  - 2. Assist Architect in inspection.
  - 3. Supervise correction and completion of Work as established in Architect's Inspection Reports.
- D. Final Completion:
  - 1. Assist Architect in inspection.
  - 2. Comply with requirements specified in Section 01-77-00.

**END OF SECTION**

**1.1 GENERAL**

- A. The following shall apply to this Contract:
1. In event that the Contractor or a Subcontractor, at any tier, determines that some portion of the Drawings, Specifications, or other Contract Document require clarification or interpretation, the Contractor shall submit a written Request for Interpretation (RFI) to the Architect.
  2. The RFI shall clearly and concisely set forth the issues for which the clarification or interpretation is sought, and why a response is needed. The RFI shall also set forth the Contractor's interpretation or understanding of the issues.
  3. The Contractor shall attest that prior to submitting a RFI from a Subcontractor, the General Contractor has reviewed the RFI for appropriateness and completeness and, if needed, obtained clarifications from the Subcontractor.
  4. The Architect will review each RFI, and determine whether or not the document qualifies as a Request for Interpretation as defined below. If the Architect determines that the document is not a legitimate RFI, it will be returned to the Contractor unreviewed as to content.
  5. The Architect will respond to RFI's within 5 working days of receipt from the Contractor, unless a longer time will be required to provide an adequate response. If a longer time is determined necessary, the Architect will, within 5 working days, notify the Contractor of the anticipated response time. An extension to the Contract Time will not be considered unless the Contractor submits a written request for extension to the Architect within 5 working days thereafter.
  6. Unless specifically noted to the contrary, RFI responses from the Architect will not alter requirements of the Contract Documents. If the Contractor believes that an Architect's response does affect the Contract Sum or Contract Time, the Contractor shall, within 5 working days, submit a written notice to the Architect, stating proposed changes and documenting the reasons for such changes. Failure to give such notice shall waive the Contractor's right to seek additions to the Contract Sum or extensions to the Contract Time under the Changes to the Work Article of the General Conditions.

(Cont.)

## **1.2 UNACCEPTABLE RFI CLAIMS**

- A. The Owner will not authorize increases to the Contract Sum or extensions to the Contract Time caused by Contractor's additional field or office staffing, project delays, decreased labor productivity, etc. when such claims are caused by any or all of the following:
1. Project Communications:
    - a. Routine communications between the Owner, Architect, and Contractor, including correspondence, memos, field-reports, test-reports, telephone calls, faxed messages, E-mail, etc.
  2. Substitution Requests:
    - a. Requests by Contractor to substitute products or methods of construction.
  3. Shop Drawings & other Submittals:
    - a. Contractor prepared drawings, product data, samples, etc. submitted for Architect's review to ascertain that Contractor clearly understands Project design intent and Contract Document requirements.
  4. Value Engineering Requests:
    - a. Communications regarding Contractor-originated Value Engineering requests.
  5. Non-conforming Work:
    - a. Communications regarding Work that has not been performed in compliance with the Contract Documents.
  6. Finding Existing Information:
    - a. Directing Contractor where to locate requested information within Drawings, Specifications, or other Contract Documents.

## **1.3 REQUESTS**

- A. Requests may be submitted only when Requestor cannot obtain interpretations or information through research, Contract Documents review, or other reasonable means.
- B. Requests for interpretations or information that is already contained or provided for in the Contract Documents may result in additional administrative costs, which shall be charged by the Owner to the Requestor.
- C. Requests shall include the following information:
1. Sequential Request Numbers
  2. Sender's & Receiver's names, firm names, and related addresses
  3. Request Issue Date
  4. Requested Reply Date
  5. Request Description
  6. References & Attachments
  7. Sender's Recommendations
  8. Space for Receiver's Response

**END OF SECTION**

## **1.1 GENERAL**

- A. This Section establishes procedures with respect to the development, use, transmission, and exchange of Digital Data for this Project. If and where these provisions conflict with any provisions in the Owner-Contractor Agreement, the provisions in the Agreement shall prevail.

## **1.2 DEFINITIONS**

- A. **Digital Data** means information, communications, drawings, specifications, or designs created or stored for the Project in digital form.
- B. **Confidential Information** means Digital Data containing confidential or business proprietary information that the transmitting party designates and clearly marks as “Confidential”.
- C. **Party** and **Parties** refer to the signing parties to the Agreement, and includes the Party’s officers, directors, employees, consultants, agents, or subcontractors.
- D. In addition any definition included in the Agreement, **Written** or **In Writing** means any written communication sent by digital transmission that permits the recipient to print or store the communication. Communications transmitted electronically as specified herein are presumed received. **Texting Messages** are not acceptable Digital Transmission.
- E. **Project Participant** means any entity (or individual) providing services, work, equipment or materials on the Project and includes the Parties.

## **1.3 ACCURACY OF ARCHITECT’S DIGITALLY-TRANSMITTED DATA**

- A. To the best of the Architect’s knowledge, belief, and understanding the transmitted information is accurate, however the Architect makes the Data available as a convenience to the Contractor, and the Architect does not guarantee the accuracy of the Drawings or the dimensions thereon. The Contractor shall verify the accuracy of the furnished information.

## **1.4 ADJUSTMENTS TO THE AGREEMENT**

- A. If a Party believes that any requirements specified herein will result in a change in the Party’s scope of work or services warranting an adjustment in compensations, contract sum, schedule or contract time, the Party shall so notify the other Party. Failure to provide such notice shall result in a Party’s waiver of any claims for adjustment in compensation, contract sum, schedule, or contract time as a result of the established requirements.
- B. Upon such notice, the Parties shall discuss and negotiate revisions to these requirements or discuss and negotiate any adjustments in compensation, contract sum, schedule or contract time in accordance with the terms of the Agreement
- C. Notice required under this Section shall be provided within 30 days of receipt of the award of the Contract.

## **1.5 DIGITAL DATA TRANSMISSION**

- A. The transmission of Digital Data constitutes a warranty by the Transmitting Party to the Receiving Party that the Transmitting Party is the copyright owner of the Digital Data, or otherwise has permission to transmit the Digital Data for its use on the Project.
- B. If a Party transmits Confidential Digital Data, the transmission of such Confidential Digital Data constitutes a warranty to the Party receiving the Confidential Digital Data that the transmitting Party is authorized to transmit the Confidential Digital Data. If a Party receives Confidential Digital Data, the receiving Party shall keep the Confidential Digital Data confidential and shall not disclose it to any other person or entity except to (1) its employees, (2) those who need to know the content of the Confidential Information in order to perform services or construction solely and exclusively for the Project, or (3) its consultants and contractors whose contracts include similar restrictions on the use of Confidential Information.
- C. The Transmitting Party does not convey any ownership right in the Digital Data or in the software used to generate the Data. The Receiving Party may not use the Digital Data unless permission to do so is provided in the Agreement, other documents incorporated by reference in the Agreement, such as the General Conditions of the Contract for Construction, or in any separate license.
- D. Unless otherwise granted in a separate license, the Receiving Party's use, modification, or further transmission of the Digital Data, is specifically limited to the design and construction of the Project, and nothing contained in this Section conveys any other right to the use of the Digital Data for another purpose.
- E. To the fullest extent permitted by law, the Receiving Party agrees to make no claim or bring any action against the Transmitting Party that may arise out of the use of Digital Data.
- F. To the furthest extent permitted by law, the Receiving Party shall indemnify and defend the Transmitting Party from any and all claims arising from or related to the Receiving Party's modification to, or unlicensed use of, the Digital Data.

## **1.6 DIGITAL DATA MANAGEMENT**

- A. If the Project Participants intend to utilize a centralized electronic management system on the Project, the Project Participants shall be responsible for managing and maintaining such systems. The Project Participants responsible for managing and maintaining the centralized electronic document management system shall facilitate the establishment of protocols for transmission, use, storage and archiving of the centralized Digital Data and assist the Project Participants in preparing Digital Data protocols. Upon agreement to, and documentation of the Digital Data protocols, the Project Participants shall manage and maintain the centralized electronic document management system consistent with the management protocols approved by the Project Participants.

**END OF SECTION**

## **1.1 GENERAL**

- A. Pre-construction Meeting:
  - 1. Architect will:
    - a. Schedule Meeting
    - b. Make physical arrangements for Meeting
    - c. Prepare Meeting Agenda
    - d. Preside at Meeting
    - e. Record, reproduce, and distribute copies of Minutes to:
      - 1. Meeting participants
      - 2. Parties affected by decisions made at Meeting
- B. Periodic Progress Meetings and specially called Meetings throughout the progress of the Work:
  - 1. Contractor shall:
    - a. Prepare Meeting agenda.
    - b. Distribute each Meeting Notice at least 2 days in advance of Meeting.
    - c. Make physical arrangements for Meetings.
    - d. Preside at Meetings.
    - e. Record Meeting minutes, including significant proceedings and decisions.
    - f. Reproduce and distribute copies of Minutes within 3 days after each Meeting to each of the following:
      - 1. All Meeting participants
      - 2. All parties affected by decisions made at Meeting
      - 3. Architect
      - 4. Owner's Representative
  - 2. Representatives of Contractor, Subcontractors, and Suppliers attending Meetings shall be qualified and authorized to act on behalf of entity each represents.
  - 3. Architect, Architect's Professional Consultants, and Owner's Representative may attend Meetings to ascertain that Work is executed consistent with Contract Documents and Construction Schedules.

(Cont.)

## **1.2 PRE-CONSTRUCTION MEETING**

- A. Schedule within 15 days after date of Notice to Proceed.
- B. Location: Central site, convenient for all parties, designated by Owner's Representative.
- C. Required Attendance:
  - 1. Owner's Representative
  - 2. Architect
  - 3. Contractor's Superintendent
  - 4. Major Subcontractors
  - 5. Others as appropriate
- D. Minimum Agenda:
  - 1. Identify Owner's & Contractor's authorized Representatives
  - 2. Distribution and discussion of:
    - a. List of major Subcontractors and Suppliers
    - b. Projected Construction Schedules
  - 3. Critical work sequencing
  - 4. Major Equipment deliveries and priorities
  - 5. Project coordination
  - 6. Designation of responsible personnel
  - 7. Procedures and processing of:
    - a. Field decisions
    - b. Proposal requests
    - c. Submittals
    - d. Change Orders
    - e. Applications for Payment
  - 8. Adequacy of Contract Documents distribution
  - 9. Procedures for maintaining Record Documents
  - 10. Use of premises:
    - a. Office, Staging, Storage, and Work areas.
    - b. Owner's requirements
  - 11. Construction Facilities, Controls, and Construction Aids.
  - 12. Temporary Utilities
  - 13. Safety and First-aid procedures
  - 14. Hazardous Materials
  - 15. Security procedures
  - 16. Housekeeping procedures
  - 17. Inspection procedures
  - 18. Product recycling & Waste management
  - 19. Laboratory Testing Services
  - 20. Contract Closeout & Commissioning requirements

(Cont.)

### **1.3 PROGRESS MEETINGS**

- A. Weekly meetings shall be held at the Jobsite to coordinate the Work, answer questions, and resolve problems.
- B. The following shall attend:
  - 1. General Contractor's Superintendent
  - 2. Mechanical Contractor's Superintendent
  - 3. Electrical Contractor's Superintendent
- C. Others with interest in Project may attend and shall attend when invited.
- D. Minimum Agenda:
  - 1. Review and approval of previous meeting Minutes
  - 2. Review Work progress since previous meeting
  - 3. Field observations, problems, and conflicts.
  - 4. Problems which impede construction schedule
  - 5. Review off-site fabrication and delivery schedules
  - 6. Corrective measures and procedures to regain projected schedule
  - 7. Revisions to Construction Schedule
  - 8. Progress schedule during succeeding work period.
  - 9. Coordination of schedules
  - 10. Review submittal schedules; expedite as required.
  - 11. Product recycling and Waste management
  - 12. Maintenance of quality standards
  - 13. Pending changes and substitutions
  - 14. Record Documents status
  - 15. Review proposed changes for:
    - a. Affect on Construction Schedule and on completion date
    - b. Affect on other Project Contracts
  - 16. Other business

### **1.4 PRE-INSTALLATION CONFERENCES**

- A. When specified in individual Specification Section, convene Pre-installation Conference at Project site prior to commencing work.
- B. Require attendance of those specified.
- C. Notify Architect at least 4 days in advance of meeting date.
- D. Prepare Agenda, preside at Conference, and record and distribute Conference Minutes with copy to Architect.

(Cont.)



**1.4 PRE-INSTALLATION CONFERENCES (Cont.)**

- E. Minimum Agenda:
1. Contract Documents
  2. Options
  3. Related Change Orders
  4. Products purchase, delivery, storage, & handling.
  5. Shop Drawings, Product Data, & Samples, when required.
  6. Compatibility of Products
  7. Possible conflicts
  8. Effects of Work on Progress Schedule
  9. Weather limitations
  10. Manufacturer's instructions and recommendations
  11. Acceptability of Substrate
  12. Temporary Facilities
  13. Work space and access
  14. Governing regulations
  15. Safety
  16. Inspection and testing requirements
  17. Maintenance requirements
  18. Protection

**1.5 PROJECT CLOSEOUT CONFERENCE**

- A. At location and time convenient with Owner and Architect, Contractor shall convene Protect Closeout Conference at least 30 calendar days prior to Contract Substantial Completion.
- B. Require Attendance:
1. Owner's Representative
  2. Architect's Representative
  3. General Contractor's Representative
- C. Prepare Agenda, preside at Conference, and record and distribute Conference Minutes with copy to Owner and Architect.
- D. Minimum Agenda:
1. Substantial Completion and Final Acceptance Inspections procedures
  2. Contract Closeout Submittals including Record Documents and Operating & Maintenance Data
  3. Owner's Occupancy procedures, including Owner's Furniture and Equipment installation
  4. Temporary Facilities & Controls removal

**END OF SECTION**

## **1.1 GENERAL**

- A. Prepare and submit to Architect estimated Progress Schedules for the Work, with Sub-schedules of Related Activities which are essential to its progress.
- B. Revise Schedules when appropriate.
- C. If Contractor fails to deliver Schedule on time or properly update Schedule, Architect may withhold Progress Payment approval until such time as Contractor complies with these requirements.
- D. If, in Architect's opinion, Work progress falls behind approved Schedule, Contractor shall take necessary action to regain lost time. Contractor shall increase Work amount, or number of shifts, or establish overtime operations, or all three, and submit for review Schedule revisions in which progress rate will be regained, all without additional cost to the Owner.
- E. Contractor's failure to comply with these requirements shall be grounds for determination that Contractor is not prosecuting Work with such diligence as will insure Project completion within specified time. Upon such determination Owner may terminate Contractor's right to proceed with Work, or any separable part thereof, in accordance with General Conditions.
- F. The Contractor and all Subcontractors, Suppliers, and Manufacturers shall schedule material deliveries and installations to conform to the Schedule, and provisions to this effect shall be included in all Subcontracts.

## **1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS**

- A. Project Meetings: Section 01-31-50
- B. Shop Drawings, Product Data, & Samples: Section 01-33-00

## **1.3 SCHEDULES**

- A. Form: Bar Graph
- B. Horizontal Time Scale: Identify first Work Day of each Week.
- C. Scale and Spacing: Allow space for notations and future revisions.
- D. Headings: Include separate heading for each Specification Section Title and Section Number listed in Project Manual Table of Contents.

## **1.4 SCHEDULE CONTENTS**

- A. Construction Progress Schedule:
  - 1. Show complete sequence of construction by activity, including any Work performed by Owner.
  - 2. Show dates for beginning, and completion, of each major element of Work.

(Cont.)

**1.4 SCHEDULE CONTENTS (Cont.)**

- B. Submittal Schedule for Shop Drawings, Product Data, and Samples:
  - 1. Show dates for Contractor's submittals.
  - 2. Show dates Submittals will be required for Owner-furnished Products.
  - 3. Show dates Approved Submittals will be required from the Architect.
- C. Products Delivery Schedule:
  - 1. Show delivery dates for Products furnished by Owner.

**1.5 SCHEDULE REVISIONS**

- A. Indicate progress of each Activity up to date of each Schedule submission.
- B. Show changes occurring since previous Schedule submission, including the following:
  - 1. Major changes in scope
  - 2. Activities modified since previous submission
  - 3. Revised projections of progress and completion
  - 4. Other identifiable changes
- C. Provide a Narrative Report as needed to define:
  - 1. Problem areas, anticipated delays, and related impact on Schedule.
  - 2. Corrective action recommended, and expected effect.
  - 3. The effect of changes on schedules of other Prime Contractors.

**1.6 SCHEDULE SUBMISSIONS**

- A. Submit initial Schedule at or before Pre-construction Conference.
- B. Architect will review Schedules and return Review Copy within 10 days after receipt. Architect's review will be for Schedule Format and Content only, and will not include Schedule "achievability", which is Contractor's responsibility.
- C. If required, resubmit within 7 days after return of Review Copy.
- D. At each weekly Progress Meeting, submit 2-week Projected Progress Schedule, which shall include Work to be performed during current week and following week.
- E. Submit updated overall Progress Schedules with each Application for Payment.
- F. Submit 1-digital approved copy of each submission for Architect's permanent use.

**1.7 DISTRIBUTION**

- A. Distribute copies of Schedules to:
  - 1. Jobsite file
  - 2. Subcontractors
  - 3. Architect
  - 4. Owner's Representative
  - 5. Other concerned parties
- B. Instruct recipients to report promptly to Contractor, in writing, any problems anticipated by projections shown in Schedules.

**END OF SECTION**

## **1.1 GENERAL**

- A. Extent of Work:
  - 1. Submit Shop Drawings, Product Data, and Samples only for those Items specifically required. The Architect will not be obligated to review Shop Drawings, Product Data, or Samples other than those required by the Contract Documents.
  - 2. Incomplete Submittals will be returned without review.
- B. Related Requirements specified Elsewhere:
  - 1. Definitions, and additional requirements: See General Conditions
- C. Submittal Schedule:
  - 1. Designate in Construction Schedule, or in separate coordinated Schedule, submission dates and dates that reviewed Shop Drawings, Product Data, and Samples will be needed.

## **1.2 REQUIREMENTS**

- A. Shop Drawings:
  - 1. Identify Shop Drawing Details by reference to Drawing Sheet, Detail, Schedule, or Room Number shown on Contract Drawings.
  - 2. Sheet Size: 8-1/2 x 11 inch, or folded to that size to facilitate filing or PDF submission.
- B. Product Data:
  - 1. Clearly mark each copy to identify pertinent Products.
  - 2. Show performance characteristics and capacities.
  - 3. Show dimensions and required clearances.
  - 4. Show wiring and piping diagrams, and controls.
  - 5. Manufacturer's standard schematic drawings and diagrams:
    - a. Modify to delete information not applicable to Work.
    - b. Supplement standard information to provide information specifically applicable to Work.
- C. Samples:
  - 1. Size & Quantity: See respective Specification Sections.
  - 2. Show full range of color, texture and pattern.

(Cont.)

### **1.3 CONTRACTOR'S RESPONSIBILITIES**

- A. Review and approve Shop Drawings, Product Data, and Samples prior to submission.
- B. Determine and verify:
  - 1. Field measurements
  - 2. Product Quantities
  - 3. Field construction criteria
  - 4. Catalog numbers and similar data
  - 5. Conformance with Specifications
- C. Comply with Contract Documents.
- D. Coordinate each Submittal with requirements of Work.
- E. Notify Architect in writing, at submission time, of any deviations in Submittals from Contract Document requirements.
- F. Perform no Work or Fabrication requiring Submittal until Architect approves Submittal.

### **1.4 SUBMISSION REQUIREMENTS**

- A. Using the following **Submittal Transmittal Form (CSI Form 12.1A)**, make submittals promptly in accordance with approved Progress Schedule, and in such sequence as to cause no Work delay.
- B. Submission Method: Digital
- C. Submittal Routing:
  - 1. Shop Drawings:
    - a. Architectural Work: Submit to Architect.
    - b. Structural, Civil, Plumbing, HVAC, and Electrical Work: Submit directly to Architect's appropriate Consultant, plus copy to Architect. Consultant will return copies to Architect with comments and corrections.
    - c. Architect will return copy to Contractor with comments and corrections.
    - d. Contractor shall resubmit copy of corrected Drawings for Architect's permanent files, plus copy to Architect's Consultants when applicable.
  - 2. Product Data:
    - a. General:
      - 1. Include Manufacturer's detailed specifications and data sheets which describe Products. Cross-out any information that does not relate to this Project. Identify any deviations from requirements specified in Contract Documents.
    - b. Architectural Products:
      - 1. Submit to Architect.
    - c. Civil, Structural, Plumbing, HVAC, & Electrical Products:
      - 1. Submit directly to appropriate Engineer, plus copy to Architect.
  - 3. Samples:
    - a. Submit as stipulated in respective Specification Section.
    - b. Digitally-submitted Color and Texture Samples are not acceptable.

(Cont.)

**1.4 SUBMISSION REQUIREMENTS (Cont.)**

**D. Submittals shall contain:**

4. Project Title and names of Contractor, Supplier, and Manufacturer, all visible on outside of Submittal.
5. Product identification complete with Specification Section number.
6. Field measurements clearly identified as such.
7. Applicable Standards, such as ASTM or Federal Specification numbers.
8. Identification of deviations from Contract Documents.
9. Identification of resubmittal revisions.
10. Contractor's Stamp, signed and certifying that Products, field measurements, field construction criteria, and information submitted has been reviewed and accepted by Contractor as accurate and conforming with Contract Documents. Submittals not bearing Contractor's signed Approval Stamp will be returned unreviewed.
11. At least 6x8 inch space on 1st page for Architect's Approval Stamp.

(Cont.)



**SUBMITTAL  
TRANSMITTAL**

Project: \_\_\_\_\_ Date: \_\_\_\_\_  
A/E Project Number: \_\_\_\_\_

**TRANSMITTAL** To (Contractor): \_\_\_\_\_ Date: \_\_\_\_\_ Submittal No. \_\_\_\_\_  
**A** From (Subcontractor): \_\_\_\_\_ By: \_\_\_\_\_ ☐ Resubmission

Qty.	Reference / Number	Title / Description / Manufacturer	Spec. Section Title and Paragraph / Drawing Detail Reference

- |  |   |
|--|---|
| <input type="checkbox"/> Submitted for review and approval                 | <input type="checkbox"/> Substitution involved - Substitution request attached  |
| <input type="checkbox"/> Resubmitted for review and approval               | <input type="checkbox"/> If substitution involved, submission includes point-by-point comparative data or preliminary details |
| <input type="checkbox"/> Complies with contract requirements               | <input type="checkbox"/> Items included in submission will be ordered immediately upon receipt of approval                    |
| <input type="checkbox"/> Will be available to meet construction schedule   |   |
| <input type="checkbox"/> A/E review time included in construction schedule |   |

Other remarks on above submission: \_\_\_\_\_ ☐ One copy retained by sender

**TRANSMITTAL** To (A/E): \_\_\_\_\_ Attn: \_\_\_\_\_ Date Rec'd by Contractor: \_\_\_\_\_  
**B** From (Contractor): \_\_\_\_\_ By: \_\_\_\_\_ Date Trnsmt'd by Contractor: \_\_\_\_\_

- |  |  |
|--|--|
| <input type="checkbox"/> Approved          | <input type="checkbox"/> Revise / Resubmit   |
| <input type="checkbox"/> Approved as noted | <input type="checkbox"/> Rejected / Resubmit |

Other remarks on above submission: \_\_\_\_\_ ☐ One copy retained by sender

**TRANSMITTAL** To (Contractor): \_\_\_\_\_ Attn: \_\_\_\_\_ Date Rec'd by A/E: \_\_\_\_\_  
**C** From (A/E): \_\_\_\_\_ ☐ Other By: \_\_\_\_\_ Date Trnsmt'd by A/E: \_\_\_\_\_

- |   |  |
|---|--|
| <input type="checkbox"/> Approved                     | <input type="checkbox"/> Provide file copy with corrections identified                         |
| <input type="checkbox"/> Approved as noted            | <input type="checkbox"/> Sepia copies only returned  |
| <input type="checkbox"/> Not subject to review        |  |
| <input type="checkbox"/> No action required           | <input type="checkbox"/> Point-by-point comparative data required to complete approval process |
| <input type="checkbox"/> Revise / Resubmit            | <input type="checkbox"/> Submission Incomplete / Resubmit                                      |
| <input type="checkbox"/> Rejected / Resubmit          |  |
| <input type="checkbox"/> Approved as noted / Resubmit |  |

Other remarks on above submission: \_\_\_\_\_ ☐ One copy retained by sender

**TRANSMITTAL** To (Subcontractor): \_\_\_\_\_ Attn: \_\_\_\_\_ Date Rec'd by Contractor: \_\_\_\_\_  
**D** From (Contractor): \_\_\_\_\_ By: \_\_\_\_\_ Date Trnsmt'd by Contractor: \_\_\_\_\_

Copies: ☐ Owner ☐ Consultants ☐ \_\_\_\_\_ ☐ \_\_\_\_\_ ☐ \_\_\_\_\_ ☐ One copy retained by sender

### **1.5 RESUBMISSION REQUIREMENTS**

- A. Make any corrections or changes in submittals required by Architect and resubmit until approved.
- B. Shop Drawings and Product Data:
  - 1. Revise initial drawings or data, and resubmit as specified for initial submittal.
  - 2. Identify any changes made other than those requested by Architect.
- C. Samples:
  - 1. Submit new samples as required for initial submittal.

### **1.6 ARCHITECT'S RESPONSIBILITIES**

- A. Review submittals with reasonable promptness.
- B. Affix signature and indicate approval, or requirements for resubmittal.
- C. Return submittals to Contractor for distribution, or resubmission.

### **1.7 ARCHITECT-FURNISHED COMPUTERIZED DATA**

- A. Upon 48 hour advance notice, Architect will make 1 copy only of Architect's Computerized Data, showing related portions of Architect's Drawings, which will be available for Contractor's and Subcontractors' use in the preparation of Shop Drawings.
- B. Delivery Method: Digital
- C. Cost to Contractor (*Payable to Architect*): None
- D. Liability:
  - 1. To the best of the Architect's knowledge, belief, and understanding the submitted information is accurate, however the Architect makes the Data available as a convenience to the Contractor, and the Architect does not guarantee the accuracy of the Drawings or the Dimensions thereon. The Contractor shall verify the accuracy of the furnished information.

**END OF SECTION**



**REFERENCED SPECIFICATIONS & STANDARDS****1.1 REFERENCED SPECIFICATIONS & STANDARDS**

- A. Products or workmanship specified by Referenced Specification or Standard shall comply with requirements of the Specification or Standard, except when more rigid requirements are noted on Drawings, or are specified herewith, or are required by governing Codes.
- B. Should Referenced Specification or Standard conflict with Contract Documents, request clarification from Architect before proceeding with Work.
- C. Contractual relationships of Parties to Contract shall not be altered from those described in Contract Documents by mention or inference in Referenced Specifications or Standards.
- D. Except where a specific date is specified, the date of the Referenced Specification or Standard including any amendments or revisions is that in effect as of the date of the Contract Documents.
- E. Each Entity working on this Project shall be familiar with Referenced Specifications and Standards applicable to their Work. Referenced Specifications and Standards are not bound herewith, and therefore Entities shall obtain any necessary copies from publisher, and maintain at Jobsite until Substantial Completion of their Work.

**1.2 REFERENCED TRADE ASSOCIATIONS**

- A. See specific Specification Sections.

**1.3 REFERENCED REGULATORY AGENCIES**

AASHTO      American Association of State Highway & Transportation Officials  
444 North Capitol Street, N.W.  
Washington, D.C. 20001  
(202) 624-5800

ADA           Americans with Disabilities Act  
Equal Employment Opportunity Commission  
U.S. Dept. of Justice  
U.S. Government Printing Office  
Mail Stop: SSOP  
Washington D.C. 20402-9328

ANSI           American National Standards Institute  
1819 L St. NW - Suite 600  
Washington DC 20036  
(202) 293-8020

ASA           American Standards Association  
(Now known as ANSI: See above)

(Cont.)

**REFERENCED SPECIFICATIONS & STANDARDS****1.3 REFERENCED REGULATORY AGENCIES (Cont.)**

ASHRAE	American Society of Heating, Refrigeration, & Air Conditioning Engineers 1791 Tullie Circle NE Atlanta, GA 30329 (800) 527-4723 www.ashrae.org
ASTM	ASTM International Formerly known as American Society for Testing & Materials 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959 (610) 832-9585
CCB	Construction Contractor's Board 700 Summer St. NE - Suite 300 Salem, OR 97309-5052 (503) 378-4621
CPSC	Consumer Product Safety Commission National Injury Information Clearinghouse 5401 Westbard Ave. Rm. 625 Washington, DC 20207 (301) 492-6580
CS	Commercial Standards Commodities Division Department of Commerce Washington, D.C. 20006
DEQ	Dept. of Environmental Quality 811 SW 6 <sup>th</sup> Ave. Portland, OR 97204 (503) 229-6124
EPA	US Environmental Protection Agency Region 10 - The Pacific Northwest 1200 Sixth Ave. Seattle, WA 98101 (206) 553-1200
FM	Factory Mutual Engineering & Research Corp 1151 Boston-Providence Turnpike Norwood, MA 02062 (617) 762-4300

(Cont.)

**REFERENCED SPECIFICATIONS & STANDARDS****1.3 REFERENCED REGULATORY AGENCIES (Cont.)**

Fed. Spec.	Federal Specifications of US General Services Administration Specifications & Consumer Information Distribution Sect. (WFSIS) Washington Navy Yard, Bldg. 197 Washington, D.C. 20407
IBC	International Building Code published by International Code Conference (ICC) 5203 Leesburg Pike - Suite 708 Falls Church, VA 22041
IMC	International Mechanical Code published by ICC (See IBC above)
IPC	International Plumbing Code published by ICC (See IBC above)
LCB	Landscape Contractor's Board 235 Union St. NE Salem, OR 97301 (503) 986-6561
NBFU	National Bureau of Fire Underwriters 85 John St. New York, NY 10017
NBS	National Bureau of Standards U.S. Dept. of Commerce Quince Orchard & Clopper Rds. Gaithersburg, MD 20878 (301) 975-2000
NEC	National Electric Code published by National Fire Protection Association
NFPA	National Fire Protection Association 1 Batterymarch Park Quincy, MA 02169 (617) 770-3000
OBCD	Oregon Building Codes Division Box 14470 Salem, OR 97309-0404 (503) 378-2322

(Cont.)

**1.3 REFERENCED REGULATORY AGENCIES (Cont.)**

ODOT	Oregon Dept. of Transportation 355 Capitol St. NE Salem, OR 97310 (503) 986-3200
OSFM	Oregon State Fire Marshal 4760 Portland Rd. NE Salem, OR 97305-1760 (503) 378-3473
OSHA	Occupational Safety & Health Administration 350 Winter St. NE – Room 340 Salem, OR 97309-0405 (503) 378-3272
OSSC	Oregon Structural Specialty Code Oregon Building Codes Agency 1535 Edgewater NW. Salem, OR 97310
PS	Product Standards of Commodities Division Department of Commerce Washington, DC 20203
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association A.(703) 803-2980 B. <a href="http://www.smacna.org">www.smacna.org</a>
UL	Underwriters Laboratories 333 Pfingsten Road Northbrook, IL 60062 (312) 272-8800
USAS	United States of America Standards Institute (Now known as ANSI: See above)

**END OF SECTION**

## **1.1 RELATED SECTIONS**

- A. Testing Laboratory Services: Section 01-45-30

## **1.2 EXTENT OF WORK**

- A. Contractor shall implement and maintain aggressive Quality Control Program conforming to the following requirements:
1. Monitor quality of all Work, including that of Subcontractors and Service Providers, to ensure that Work complies with Contract Documents.
  2. Include compliance with currently approved Progress Schedule.
  3. Include continuing inspections of Work.
- B. Responsibilities include, but are not limited to the following:
1. Prior to submission to Architect, and in compliance with requirements specified in Section 01-33-00, review and approve Shop Drawings, Product Data, and Samples for compliance with Contract Documents.
  2. Prior to starting Work, review appropriate Contract Drawings & Specifications, Shop Drawings, Product Data, Samples, and Contract Modifications, as well as affected Existing Conditions.
  3. Work closely and cooperate with Architect, attend required Meetings, and execute decisions reached by Architect.
  4. Assign and maintain at Jobsite, Supervisory Personnel acceptable to Owner, who have authority to act in Contractor's behalf at all times Work is being performed, including any Overtime Periods.
  5. Schedule and coordinate inspections and tests with Regulatory Agency Inspectors and with Testing Agency Personnel.
  6. Submit to Architect, Construction Manager, and Owner's Representative signed Reports of Inspections and Tests made by Building Officials, Special Inspectors, and any others performing inspections or tests.
  7. Schedule and coordinate required Pre-Installation Conferences.
  8. Assure that Record Documents, including those prepared by Subcontractors, are accurately maintained and up to date.
  9. Schedule and coordinate specified System and Equipment demonstrations and training sessions for Owner's Personnel.
  10. Make final inspections with Subcontractors of all Work to determine that Work is in compliance with Contract Documents. Prior to calling for Architect's, Construction Manager's, and Owner's Substantial Completion and Final Inspections, verify that Work deficiencies discovered during Contractor's inspections have been satisfactorily corrected.
  11. Unless otherwise directed, accompany Architect, Construction Manager, and Owner during their inspections.
  12. Coordinate final closeout procedures, including those of Subcontractors, to assure compliance with procedures specified in Section 01-77-00.

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS**

- A. Inspections and testing required by laws, ordinances, rules, regulations, and orders of Public Authorities: See General Conditions:
- B. Product Certification: See respective Specification Sections.
- C. Equipment testing, adjusting, and balancing: See respective Specification Sections.

**1.2 COSTS**

- A. Paid by Owner:
  - 1. For Testing Laboratory services specified in this Section.
  - 2. For Code-required Special Inspections of Structural Foundations, Structural Steel, Welding, Bolting, Epoxy Anchoring, Seismic Restraints, Suspended Ceilings, Firestopping, and Concrete Placing.
- B. Paid by Contractor:
  - 1. For retesting required because of defective Work or ill-timed notices, and for reinspections.

**1.3 LABORATORY'S QUALIFICATIONS**

- A. Independent Laboratory acceptable to Architect and Building Official.
- B. Meet "Recommended Requirements for Independent Laboratory Qualification," latest edition, published by American Council of Independent Laboratories; 1725 K Street, N.W.; Washington, D.C. 20036.
- C. Meet ASTM E-329 latest edition, "Standards of Recommended Practice for Inspection and Testing agencies for Concrete and Steel as used in Construction".

**1.4 LABORATORY'S DUTIES**

- A. Provide qualified Personnel for specified inspections, sampling, and testing.
- B. Ascertain and certify compliance with Contract Documents.
- C. When requested by Architect, provide interpretation of Test results.
- D. Promptly submit written Inspection & Test Reports to:
  - 1. Owner's Representative
  - 2. Building Official
  - 3. Contractor
  - 4. Architect
- E. Additionally, submit copies of the following Reports to:
  - 1. Tested Earthwork: Geotechnical Engineer
  - 2. Tested Asphaltic Concrete: Civil Engineer
  - 3. Tested Structural Work: Structural Engineer

(Cont.)

**1.4 LABORATORY'S DUTIES (Cont.)**

- F. Include the following in Test Reports:
  - 1. Date issued
  - 2. Project title, location, and Building Permit number.
  - 3. Testing Laboratory name and address
  - 4. Inspector's name
  - 5. Date of inspection or sampling
  - 6. Record of temperature and weather
  - 7. Date of test
  - 8. Identification of Product tested
  - 9. Test location in Project
  - 10. Type of inspection or test
  - 11. Observations regarding compliance with Contract Documents
- G. Laboratory is not authorized to:
  - 1. Release, revoke, alter, or enlarge on Contract Documents requirements.
  - 2. Approve or accept any portion of Work
  - 3. Assume any duties of Contractor
  - 4. Stop Work

**1.5 CONTRACTOR'S RESPONSIBILITIES**

- A. Cooperate with Laboratory Personnel, and provide access to Work and to Manufacturer's operations.
- B. Provide to Laboratory representative samples of materials to be tested, in required quantities.
- C. Furnish copies of Structural Steel Mill Test Reports to Laboratory.
- D. Furnish casual labor and facilities:
  - 1. For access to Work to be tested
  - 2. To obtain and handle Test Samples at Site
  - 3. To facilitate inspections and tests
  - 4. For Laboratory's exclusive use for storage and curing of Test Samples until removed to Laboratory
- E. Notify Laboratory at least 24 hours in advance of operations to allow for Personnel assignments and Test scheduling.
- F. Repair any Test Holes to match original conditions.

**1.6 LIABILITY**

- A. Laboratory service is provided for Owner's self-assurance, and does not relieve Contractor's responsibility to comply with Contract Documents.

(Cont.)

**PART 2 - DETAILED REQUIREMENTS**

**2.1 EARTHWORK DENSITY**

- A. Method: ASTM D-2422 (Nuclear Gauge)
- B. Provide Tests for each layer of Fill and Backfill placed in any 1 day, for Pavement Beds in cuts, if any, and for any Earthwork Construction which will support Finished Surfaces or Structures.

**2.2 ASPHALT PAVEMENT**

- A. Conduct 1 test for each 20,000 sq. ft., or less, of Pavement placed in any 1 day as follows:
  - 1. Compacted Base Rock field-density using ASTM D-2422 (Nuclear Gauge) method.
  - 2. Placement Tests to determine Asphalt-Cement content, gradation of Aggregate, Voids, Temperature, and Marshall Stability of Mix.
  - 3. Finished-product Core Sample to determine Compaction, Voids, and Thickness.

**2.3 CAST IN PLACE CONCRETE**

- A. Test Samples shall be taken at the following locations:
  - 1. At Pumped Concrete, if any: At Pump Hose discharge end
  - 2. At Rotary Mixer: At Mixer Chute discharge end
- B. Test Concrete Slump as follows:
  - 1. Follow ASTM C-143 and C-172.
  - 2. Take on-site Tests Samples from 1st Delivery Truck plus any additional Truck appearing to discharge Concrete exceeding specified Slump range.
  - 3. If Measured Slump falls outside specified limits retest immediately from another portion of same load. In event of second failure Concrete shall be considered as failing Specification requirements.
- C. Test Concrete Compressive Strength as follows:
  - 1. Follow ASTM C-31, C-39, and C-172.
  - 2. Prepare not less than 5 Test Cylinders for each 100 cu. yds. or less for each class of Concrete cast in any 1 day.
  - 3. Test-break 1 Cylinder at 7 days of age, 1 at 14 days, 2 at 28 days, and remaining Cylinder if and when directed to do so.
  - 4. If any set of 2 Cylinders does not develop full design strength at 28 days of age, Cores and Load-testing may be called for. All Coring and Load-testing costs shall be paid by Contractor.
- D. Test Concrete Air-content as follows:
  - 1. Follow ASTM C-231.
  - 2. Test each Cylinder containing Air-Entrainment.

(Cont.)



### **2.3 CAST IN PLACE CONCRETE (Cont.)**

- E. Test Slab Flatness as follows:
  - 1. Perform measurement with 10 ft. minimum length Highway Straightedge within 16 hours following completion of final troweling. Within 2 hours following completion of Test, notify Contractor and Architect whether or not Work has successfully passed Test, and specifically identify any areas which have failed Test.

### **2.4 STRUCTURAL STEEL**

- A. Inspection at Fabrication Shop and Jobsite as follows:
  - 1. Qualification of Bolting and Welding procedures and personnel.
  - 2. Inspection of fabricated Structural Steel Members and Assemblies for compliance with the following:
    - a. Drawings and Specifications
    - b. Structural Notes on Drawings
- B. When authorized by Structural Engineer, inspect Welds by the following methods:
  - 1. Magnetic Particle: ASTM E-709
  - 2. Liquid Penetration: ASTM E-165
  - 3. Radiographic: AWS Specification D1.1
  - 4. Ultrasonic: AWS Specification D1.1
  - 5. Visual: AWS Specification D1.1.6.9

### **2.5 CONCRETE FLOOR SLAB MOISTURE & VAPOR CONTENT**

- A. At 30 days and at 5 days prior to Flooring placement, determine Moisture-content and Vapor-emission rate of Concrete to receive Flooring as follows:
  - 1. Moisture Content measured at Slab Center: ASTM E-1907
  - 2. In-situ RH Vapor-Emission Rate: ASTM F-2170

### **2.6 CONCRETE FLOOR SLAB WATER-ABSORPTION (POROSITY)**

- A. Test Method to determine Porosity of Concrete to receive Flooring: ASTM F-3191
  - 1. If at or before 1-minute 1-drop of Water absorbs into Concrete: Slab is considered Porous
  - 2. If after 1-minute 1-drop of Water has not absorbed into Concrete: Slab is considered Non-porous

### **2.7 FIRESTOPPING TESTING**

- A. As specified in Section 07-84-00, test Firestopping in compliance with ASTM E-2174 and E-2393.

**PART 2 - DETAILED REQUIREMENTS**

**2.8 WATER-INFILTRATION TESTING**

- A. As specified in Section 08-40-00, test Exterior Wall and Window Assemblies as stipulated in AAMA 501.2.

**END OF SECTION**

**OWNER'S PROJECT REPRESENTATIVE'S DUTIES & AUTHORITY****1.1 GENERAL**

- A. An Owner's Project Representative will at intervals be stationed at the Project Site, and the Representative will be responsible for assisting the Architect in the administration of the Contract. The responsibilities, obligations, and rights of the Architect, as described in the Agreement between the Owner and the Architect, will not be altered or modified by the furnishing of such Project Representative.
- B. Communication by the Owner's Project Representative related to the administration of the Contract shall, in general, be restricted to the Architect and the Contractor. The Project Representative shall communicate with the Owner and the Contractor under the direction of the Architect and with the Architect's full knowledge. The Project Representative shall not communicate directly with Subcontractors or with Product Suppliers except with the full knowledge and approval of the Contractor and the Architect.

**1.2 DUTIES & RESPONSIBILITIES**

- A. The Project Representative shall:
  - 1. Perform on-site observations of the progress and quality of the Work as may be reasonably necessary to determine, in general, if the Work is being performed in a manner indicating that the Work when completed will be in conformance with the Contract Documents.
  - 2. Notify the Architect immediately if, in the Project Representative's opinion, Work does not conform to the Contract Documents or the Work requires special inspection or testing.
  - 3. Monitor the Contractor's Construction Progress Schedules on an on-going basis, and alert the Architect to conditions that could lead to delays in the completion of the Work.
  - 4. Receive and respond to requests from the Contractor for information, and when authorized by the Architect, provide interpretations of the Contract Documents.
  - 5. Receive and review requests for changes by the Contractor, and submit them, together with Representative's recommendations, to the Architect. If requests are accepted, prepare Architect's Supplemental Instructions, incorporating the Architect's Modifications to the Contract Documents.
  - 6. Attend Progress Meetings, and report proceedings to the Architect.
  - 7. Observe tests required by the Contract Documents. Record and report to the Architect on test procedures and test results. When appropriate, approve testing invoices to be paid by the Owner.
  - 8. Maintain records at the Project Site in an orderly manner. Include Correspondence, Contract Documents, Change Orders, Construction Change Directives, reports of site meetings, Shop Drawings, Product Data, and similar submittals; supplementary drawings, color schedules, Applications for Payment; and names, addresses, and telephone numbers of the Contractors, Subcontractors, and principal Material Suppliers.

(Cont.)

**OWNER'S PROJECT REPRESENTATIVE'S DUTIES & AUTHORITY****1.2 DUTIES & RESPOSIBILITES (Cont.)****B.** The Project Representative shall:

1. Maintain a log book of activities at the Project Site, including weather conditions, nature and location of Work being performed, verbal instructions and interpretations given to the Contractor, and specific observations. Record any occurrence or Work that might result in a claim for a change in Contract Sum or Contract Time. Maintain a list of Jobsite Visitors, their titles, and time and purpose of their visit.
2. Assist the Architect in reviewing Shop Drawings, Product Data, and Samples. Notify the Architect if any portion of the Work requiring Shop Drawings, Product Data, or Samples is commenced before such submittals have been approved by the Architect. Receive and log Samples which are required to be furnished at the Project Site, notify the Architect when they are ready for examination, and record the Architect's approval or other action. Maintain custody of approved Samples.
3. Review the Contractor's record copy of the Drawings, Specifications, Addenda, Change Orders, and other Modifications at intervals appropriate to the stage of Work, and notify the Architect of any apparent failure by the Contractor to maintain up-to-date records.
4. Review Applications for Payment and forward Applications to the Architect with the Representative's recommendations for disposition.
5. Review the List of Items to be completed or corrected included with the Contractor's Request for Issuance of a Certificate of Substantial Completion. If the List is accurate, forward the List to the Architect for final disposition. If List is not accurate, so advise the Architect, and return the List to the Contractor for correction.
6. Assist the Architect in conducting inspections to determine the Substantial Completion Date(s) and Final Completion Date.
7. Review Contractor's Contract Closeout Submittals and transmit Submittals to the Architect with the Representative's recommendations for disposition.

**1.3 LIMITATIONS OF AUTHORITY****A.** The Project Representative shall not:

1. Exceed the authority of the Architect as stipulated in the Owner-Architect Agreement.
2. Authorize deviations from the Contract Documents.
3. Approve substitute Products, except as authorized in writing by the Architect.
4. Personally conduct or participate in tests or third party inspections, except as authorized in writing by the Architect.
5. Assume any of the responsibilities of the Contractor's Superintendent or of any Subcontractor.
6. Expedite the Work for the Contractor.
7. Have control over or charge of or be responsible for construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs in connection with the Work.

(Cont.)

**OWNER'S PROJECT REPRESENTATIVE'S DUTIES & AUTHORITY****1.3 LIMITATIONS OF AUTHORITY (Cont.)****A. The Project Representative shall not: (Cont.)**

8. Authorize or suggest that the Owner occupy the Project in whole or in part.
9. Issue a Certificate for Payment or a Certificate of Substantial Completion.
10. Prepare or certify record copies of the Drawings, Specifications, Samples, Product Data, Addenda, Change Orders, or other Work Modifications.
11. Reject Work or require special inspection or testing, except as authorized in writing by the Architect.
12. Accept, distribute, or transmit submittals made by the Contractor that are not required by the Contract Documents.
13. Order the Contractor to stop the Work or any portion thereof.

**END OF SECTION**

**1.1 GENERAL**

- A. Comply with governing Codes and Regulations.
- B. Pay any required Fees or Easement Assessments.
- C. Enforce safe and sanitary practices.
- D. Maintain clean Facilities.
- E. Prevent interference with Owner's normal use of Owner's Facilities.
- F. Prevent wasteful Utility uses.
- G. Should Owner occupy part of Facility, Owner will pay Owner's proportional Utility cost.

**1.2 PROJECT IDENTITY SIGN**

- A. Material: Exterior-grade, Medium-density Overlaid (MDO) Plywood, and framed with suitable Perimeter Edge Moldings.
- B. Face Size: 4x8 ft.
- C. Thickness: 3/4 inch
- D. Provide immediately after Contract is signed in accordance with Architect's design.
- E. Paint with 2 coats Weatherproof Enamel in colors selected by Architect.
- F. Employ professional Sign Company approved by Architect to reproduce Pictorial Image of Project (furnished by Architect) and to letter Names of the following:
  - 1. Project
  - 2. Owner
  - 3. Architect
  - 4. Consulting Engineers
  - 5. Construction Manager
  - 6. General Contractor
- G. Locate Sign Board where directed by Architect, and secure to 2 nominal 4x4 inch Posts securely set into the Ground.

**1.3 BULLETIN BOARD**

- A. Provide 1 weatherproof 4x4 ft. Bulletin Board where regularly visible to Workers.
- B. Display Prevailing Wage Rates; employee benefits such as Health & Welfare Plan, Pension Plan, etc., if any; Equal Opportunity Employment Requirements; Emergency Telephone Numbers; and other important information.

**1.4 FIELD OFFICE**

- A. General:
  - 1. Provide substantial, weather-tight Office Building on Premises where directed.
  - 2. At Contractor's option, Contractor may use Portable Buildings suitable for office-use.
  - 3. Provide with Heat, Electric Light, and Janitorial Service.
  - 4. Do not use Field Office or Storage Buildings for Personnel housing.

(Cont.)

**1.4 FIELD OFFICE (Cont.)**

- B. Required Furnishings:
1. 1 Table large enough to hold open-set of Contract Drawings
  2. 1 Rack large enough to store Contract Drawings, including Record Drawings
  3. 1 Shelf large enough to hold Project Manuals and other similar Documents
  4. 1 metal, legal-size Filing Cabinet to store Shop Drawings and Project Correspondence
  5. May be new or used, but must be safe for use, serviceable, and adequate for intended use.

**1.5 TEMPORARY COMMUNICATIONS EQUIPMENT**

- A. In Contractor's Field Office provide the following:
1. 1 Telephone Answering & Message Recording Machine, unless Contractor's on-site Superintendent carries open Mobile Phone at all times.
  2. 1 Computer capable of transmitting, receiving, and printing E-Mail messages and Scanned Documents.
- B. Install when Work is started, maintain until Work completion, and pay all charges.
- C. Subcontractors shall provide and pay for any separate additional Instruments that they may require.
- D. Provide wall-mounted Directory at each Instrument listing Name and Business Phone Number of at least the following:
1. Each Contractor and Subcontractor
  2. Architect
  3. Architect's Consulting Engineers
  4. Testing Laboratories
  5. Physicians
  6. Hospitals
  7. Ambulance
  8. Local Fire Department
- E. Do not use Owner's existing Telephone System.

**1.6 TEMPORARY WATER**

- A. Provide and maintain Water for the following purposes:
1. Service Standpipe equipped with sufficient 3/4 inch Hydrants that any Work Center can be reached with 100 ft. Extension Hose. Equip Hydrants with Backflow Prevention Devices. Contractors shall provide their own Extension Hoses.
  2. Drinking Water dispensed in Single-service Containers or Sanitary Fountains.
  3. Temporary Toilet Facilities
- B. Maintain cool as practicable, clean, and fresh.
- C. Maintain adequate volume.
- D. Protect against freezing.

(Cont.)

**1.6 TEMPORARY WATER (Cont.)**

- E. Water Source:
1. Water, in quantities judged reasonable by Architect, will be furnished without charge by Owner.
  2. Ascertain where Water Service is available, provide required connections, and extend System to Work area.

**1.7 TEMPORARY TOILET FACILITIES**

- A. Provide Toilet and Washing Facilities in accordance with governing Regulations. Chemical Toilets equipped with Waterless Hand Cleaners will be permitted.
- B. For Enclosures accommodating more than 1 Person, provide Privacy Screens for each Toilet Fixture.
- C. Provide separate Facilities for each gender.
- D. Maintain each Toilet with Toilet Tissue on suitable Dispenser.
- E. Remove Temporary Toilets and use Building Fixtures as soon as feasible.
- F. Where necessary, disinfect Premises after Toilet removal and restore to specified condition.
- G. Do not use Owner's existing Toilet Facilities.

**1.8 TEMPORARY FIRST-AID FACILITIES & DEVICES**

- A. Provide adequate First Aid Facilities and Devices for Project Workers.

**1.9 TEMPORARY BARRICADES**

- A. Provide all necessary to protect Public and Workers against injury and to protect Project against damage and unauthorized intrusion.

**1.10 TEMPORARY EXTERIOR ENCLOSURES**

- A. Provide sufficient Enclosures to prevent infiltration of Rainwater, Wind, and other Elements, and prevent undue Heat Loss from within Enclosed Area.
- B. At no additional cost to Owner, clean, repair, and, when directed, replace any Building Materials or Contents which have been damaged or discolored because of lack of enclosure.

**1.11 TEMPORARY FIRE PROTECTION**

- A. Provide and maintain necessary Facilities and Equipment to safeguard Project against Fire Damage.



## **1.12 TEMPORARY ELECTRICITY**

### **A. Power:**

1. Provide and maintain structurally and electrically sound, Code-approved, Temporary Power Distribution System as follows:
  - a. Sufficient Load Centers that any Work Area can be reached with 100 ft. long Extension Cord. General Contractor and each Subcontractor shall provide their own grounded, UL-approved Extension Cords.
  - b. Load Centers shall include:
    1. Weatherproof Distribution Boxes
    2. Circuit Breakers for each Outlet
    3. Equipment Grounding Continuity for entire System
    4. Power at proper voltage for:
      - a. Temporary Field Offices
      - b. Temporary Storage and Construction Buildings
      - c. Temporary Lighting and Power
      - d. Temporary Heating and Ventilating
      - e. Temporary Fire Alarm System
      - f. Pumping
      - g. Testing and checking Equipment
      - h. Owner's Facilities continuous operation during Electrical Services change-over
2. General Contractor, other Prime Contractors, and each Subcontractor shall provide their own power and distribution system for Field Welders and any other Special Power beyond that specified herein.

### **B. Lighting:**

1. Provide and maintain Temporary Lighting at least as follows:
  - a. 30 ft. candles measured 3 ft. above Floor in spaces during work. Energize permanent Lighting Fixtures prior to painting, except where Fixtures are mounted on Walls or Ceilings to be painted. Maintain from 15 minutes prior to until 15 minutes past scheduled Work hours.
  - b. 5 ft. candles measured 3 ft. above Floor where necessary to prevent damage or injury. Maintain when authorized Personnel are present. Provide Light Control Switches at Area Entrances and successive Areas so Personnel access to Project can be through lighted Areas.
  - c. 1 ft. candle measured 3 ft. above Ground as required to illuminate Project Grounds. Control Lights by Photo-electric Cell set to energize Lights from dusk to dawn.
2. Unless otherwise protected, cover exposed Interior Lamps with Guards.

### **C. Wiring:**

1. Prevent conflict with General Construction.
2. Maintain Cords clear of Walkways and other Heavy-traffic Areas.

### **D. Power Source:**

1. Electricity, in quantities judged reasonable by Architect, will be furnished without charge by Owner.
2. Ascertain where Electrical Service is available, provide required connections, and extend System to Work Area.

**1.13 TEMPORARY HEATING & VENTILATING**

- A. Provide Temporary Heat and Ventilation throughout enclosed construction areas to:
  - 1. Facilitate Work progress.
  - 2. Protect Work and Products against Dampness and Cold.
  - 3. Prevent Moisture Condensation on Surfaces.
  - 4. Provide suitable Ambient Temperatures and Humidity Levels for installation and curing of Products.
  - 5. Provide adequate Ventilation to meet health regulations for Safe Working Environment.
- B. If temporary Portable Heaters are used, exhaust Heater Exhaust Fumes by Ductwork directly to Building Exterior. Do not allow Heaters to over-dry adjacent Materials.
- C. Continue Temporary Heating and Ventilating until Owner occupies or finally accepts Project, whichever is sooner.
- D. Maintain Ventilated Areas in clean condition to avoid undue circulation of Dust and Air-borne Particles.
- E. After Building enclosure, maintain the following Interior Conditions:
  - 1. Temperature (24 hours a day) unless otherwise specified elsewhere: 55°F to 75°F
  - 2. Minimum Air Changes: 1 each 2 hours
  - 3. Maximum Relative Humidity: 50%
- F. Permanent Building System use:
  - 1. Operate no permanent Heating or Ventilating Equipment without Mechanical Engineer's authorization that Equipment is properly installed, has clean Air Filters, and is otherwise suitable for use.
  - 2. Use of permanent Equipment for "temporary" purposes shall not alter Equipment Warranty Period start-date, which shall remain date of Project Substantial Completion.
  - 3. Maintain System for proper operation.
  - 4. If adjacent Site Work is producing Dust, do not intake Outside Air, and cover Outside Air Intakes with 30% minimum-efficiency Air Filters.
  - 5. Immediately prior to Substantial Completion of Project replace Air Filters with new Units, and restore System to like-new condition.
- G. Fuel costs shall be paid by Contractor.

**1.14 TEMPORARY MOLD-PREVENTION VENTILATION**

- A. Provide sufficient Ventilation within Project Areas to exhaust Moisture from Ambient Air and from Products as required to prevent development of Mold or Mycotoxins.

**1.15 TEMPORARY VERTICAL TRANSPORTATION**

- A. General Contractor shall provide and pay costs for Temporary Stairs, Ramps, Chutes, etc., required for execution of Work of all Trades, including that required for other Prime Contractors. Subcontractors and other Prime Contractors shall provide their own Material Hoists, Ladders, and Scaffolds.

**1.16 TEMPORARY EQUIPMENT**

- A. Thermometer:
  - 1. Maintain one 10 inch minimum size Outdoor Thermometer. Mount at convenient location not in direct sunlight.
  - 2. Temperature Range: Minus 30°F to plus 110°F.
- B. Protective Wear:
  - 1. For Visitors' use, provide 6 each of the following:
    - a. Adjustable-size OSHA-approved Protective Helmets
    - b. Safety Glasses
    - c. Safety Vests

**1.17 TEMPORARY FACILITIES REMOVAL**

- A. Remove Temporary Facilities at Project completion or sooner, if directed.
- B. Repair any damage resulting from Temporary Facilities, including that to existing Street Trees to remain.

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Earthwork: Section 02-30-00
- B. Trenching & Backfill for Utilities: Section 02-31-50

**1.2 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.3 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**PART 2 - PRODUCTS**

**2.1 TEMPORARY FENCING & BARRICADES**

- A. Material: Contractor's choice
- B. Type: Satisfy conditions of use

**PART 3 - EXECUTION**

**3.1 PROTECTION**

- A. Except if and where indicated to be removed, protect existing Street Trees against damage.
- B. Do not attach Ropes, Cables, or Guys to existing Trees.
- C. Provide necessary Fencing and Barricades. Erect prior to Work, and unless otherwise instructed, remove after Work completion.
- D. Prohibit Earth stockpiling, Material storage, and Vehicle Parking and Traffic within Drip-line of Trees.
- E. Prohibit dumping of Refuse, Chemicals, and other Materials, and puddling or running Water which may injure Plant growth including Root Systems.
- F. Prohibit Foot and Vehicle Traffic which may compact Soil over Root Systems.
- G. Prohibit unnecessary cutting, breaking, and skinning of Branches and Roots.
- H. Prohibit skinning and bruising of Bark.
- I. Prohibit Fires, High-heat, and Smoke adjacent to Trees.

**PART 3 - EXECUTION**

**3.2 WATERING**

- A. During Contract Period, water remaining Trees as required to maintain health.

**3.3 EXCAVATION AROUND TREES**

- A. Excavate within Drip-line of Trees only where absolutely necessary.
- B. Where Utility Trenching is required within Drip-line of Trees, tunnel under and around Roots by hand-digging. Do not cut Main Lateral Roots or Tap Roots.
- C. Where excavating for new Construction is required within Drip-line of Trees, hand-excavate to minimize damage to Root Systems. Use Narrow tine Spading Forks and comb soil to expose Roots. Relocate Roots back into Backfill Areas wherever possible. If large Main Lateral Roots are encountered, expose beyond excavation limits as required to bend and relocate Roots without breaking.
- D. If Root relocation is not practical, hand-cut Roots approximately 3 inches back from new construction.
- E. Do not allow exposed Roots to dry before permanent Backfill is placed; provide temporary Earth cover, or pack with Wet Peat Moss.
- F. Temporarily support and protect Roots against damage until permanently relocated and covered with Backfill.

**3.4 PRUNING**

- A. Engage Certified Arborist to prune damaged Trees and Shrubs where Roots have been cut or lost.
- B. Cut Branches and Roots as close as possible to Trunk or Limb, leaving no more than 1/2 inch Stub exposed. Perform with sharp Pruning Instruments; do not break or chop.

**3.5 GRADING & FILLING AROUND TREES**

- A. General:
  - 1. Maintain existing Grade within Drip-line of Trees, unless otherwise shown on Drawings.
- B. Lowering Grades:
  - 1. Carefully hand excavate within Drip-line to new Finish Grade.
  - 2. Cut Roots exposed by excavation to approximately 3 inches below elevation of new Finish Grade. Remove Cut-roots larger than 1 inch diameter.
- C. Raising Grades:
  - 1. Where existing grade is 6 inches or less below Finish Grade shown, use existing Topsoil Fill Materials. Carefully place in single layer, do not compact. Hand-grade to required Finish Elevations.
  - 2. Where Existing Grade is more than 6 inches below Finish Grade shown, follow Architect's instructions.

**PART 3 - EXECUTION**

**3.6 REPAIR & REPLACEMENT OF TREES**

- A. Repair Trees damaged by Construction Operations.
- B. Engage Certified Arborist to perform Tree Repair Work.
- C. Make Repairs promptly after Damage occurs to prevent progressive Tree deterioration.
- D. Remove and replace dead and damaged Trees which are determined by Certified Arborist to be incapable of recovery to Normal Growth pattern.
- E. Unless otherwise approved, provide new Trees of same size and species as those removed. Plant and maintain as specified in Landscaping Sections.
- F. Where damaged Trees cannot realistically be repaired or replaced, pay Owner, as Liquidated Damage, value of Trees as determined by Guide for Establishing Values of Trees & Other Plants as prepared by Council of Tree & Landscape Appraisers and as distributed by International Society of Arboriculture. Copies can be obtained from Society at 270 Peachtree St. NW; Suite 1900; Atlanta, GA 30303; (678) 367-0981.

**END OF SECTION**

**1.1 REQUIREMENTS INCLUDED**

- A. Establish and maintain Project Security Program to protect Work, Stored Products, and Construction Equipment against Theft and Vandalism.

**1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS**

- A. Storage and Protection of Products: Section 01-60-00

**1.3 MAINTENANCE OF SECURITY**

- A. Initiate Security Program promptly after Job Mobilization.
- B. Maintain Security Program throughout construction period, until Owner-occupancy or Owner-acceptance precludes the need for Contractor-security.

**END OF SECTION**

## **1.1 GENERAL**

- A. Materials and Equipment incorporated into Work shall:
  - 1. Conform to applicable Specifications and Standards.
  - 2. Comply with size, make, type, and quantity specified, unless otherwise approved in writing.
- B. Manufactured and Fabricated Products:
  - 1. Manufacture like parts of duplicate units to standard sizes and gauges, and to be interchangeable.
  - 2. Two or more items of same kind shall be identical, and by same Manufacturer.
  - 3. Products shall be suitable for service conditions.
  - 4. Equipment shall comply with capacity, sizes, and dimensions shown or specified, unless otherwise approved in writing.
- C. Do not use Materials or Equipment for any purpose other than that for which designed or specified.

## **1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS**

- A. Shop Drawings, Product Data, & Samples: Section 01-33-00
- B. Product Substitutions: Section 01-63-00
- C. Cleaning: Section 01-74-00

## **1.3 CONTRACTOR'S OPTIONS**

- A. For Products specified only by Referenced Standard, select any Product meeting Standard.
- B. For Products specified by naming several Products, select any one complying with Specifications.
- C. For Products specified by naming one or more Products and "or approved", select any one specified Product or submit request for substitution as specified in Section 01-63-00.

## **1.4 INAPPROPRIATE PRODUCTS OR METHODS**

- A. If Contractor believes that any specified Product, Method, or System is inappropriate for use Contractor shall, if possible, so notify Architect at least 5 Working Days prior to Contract award. If 5-day advance notice is not possible, such notice shall be given as soon as possible before performing Work in question.
- B. If notice of objection is not received within time limits specified above, it will be assumed by Owner that Contractor agrees that specified Products, Methods, and Systems are not inappropriate for use on Project.

(Cont.)



### **1.5 QUANTITY OF PRODUCTS REQUIRED**

- A. Whenever in Specifications a Product is referred to in singular number, such reference shall include as many such Products as are shown on Drawings or are required to complete the Work.

### **1.6 PRODUCTS LIST**

- A. Before Contractor's first request for payment, submit to Architect complete list of major Products proposed for use; include proprietary Product names, Manufacturer's name, and installing Subcontractor's name.

### **1.7 MANUFACTURERS' INSTRUCTIONS**

- A. Perform Work in accord with Manufacturers' instructions.
- B. Do not omit preparatory or installation procedures required by Manufacturer, unless specifically modified or exempted by Contract Documents.
- C. When Contract Documents require Work to comply with Manufacturers' instructions, obtain and distribute such instructions to parties performing work including 2 copies to Architect. Maintain 1 set at jobsite during installation and until acceptance.
- D. Handle, install, connect, clean, condition, and adjust Products in strict accord with such instructions and in conformance with specified requirements.
- E. Should job conditions or specified requirements conflict with Manufacturers' instructions, consult Architect for further instructions.
- F. Do not proceed with Work without clear instructions.

### **1.8 PRODUCT SUBSTITUTIONS**

- A. Refer to Section 01-63-00.

### **1.9 TRANSPORTATION & HANDLING**

- A. Arrange Product deliveries in accord with Construction Progress Schedule. Coordinate to avoid conflict with work and site conditions.
- B. Deliver Products undamaged, in Manufacturer's original containers or packaging, and with legible identifying labels intact.
- C. Immediately upon delivery, inspect shipments to assure compliance with Contract Documents and approved Submittals requirements, and assure that Products are properly protected and undamaged.

(Cont.)

**1.10 STORAGE & PROTECTION**

- A. Follow Manufacturer's instructions.
- B. If and when necessary, provide additional Off-site Storage as specified in Section 01-29-50.
- C. Maintain Product Identity Labels intact.
- D. Store Products subject to weather-damage in weather-tight enclosures.
- E. Maintain Storage Room temperature and humidity within ranges required by Manufacturer's instructions.
- F. Maintain reasonable protection against Product theft and vandalism.
- G. Exterior Storage:
  - 1. Store fabricated Products above ground, on blocking or skids; prevent Product damage and discoloration.
  - 2. Cover Products subject to deterioration with impervious sheet coverings; provide adequate ventilation to prevent condensation.
  - 3. Store loose Granular Materials on solid surface to prevent mixing with foreign matter.
- H. Inspection of Stored Products:
  - 1. Arrange Storage to permit easy access for inspection.
  - 2. Make periodic inspections of stored Products to assure that Products are maintained as specified and are free from damage, discoloration, and deterioration.
- I. Protection after Installation:
  - 1. Provide substantial Coverings as necessary to protect installed Products against damage and discoloration. Remove Covering when no longer needed.

**1.11 DAMAGED & REJECTED PRODUCTS DISPOSAL**

- A. Immediately remove from Project Site, and lawfully dispose, any Damaged or Rejected Products.

**END OF SECTION**

## **1.1 GENERAL**

- A. Wherever a Material, Article, or piece of Equipment is identified on the Drawings or in the Specifications by reference to manufacturers' or vendors' names, trade names, catalog numbers, or the like, it is so identified for the purpose of establishing a standard, and any material, article, or piece of equipment of other manufacturers or vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable provided the material, article, or piece of equipment so proposed is, in the opinion of the Architect, of equal substance, appearance, and function. Substitutions will not be approved that require extensive revisions to the Contract Documents or are not in keeping with the general intent of the Architect's design.
- B. Substituted Products shall not be purchased or installed by the Contractor without the Architect's written approval.
- C. The Architect will be sole judge of acceptability of any proposed substitution.
- D. Each request for substitution approval shall include:
  - 1. Identity of Product for which substitution is requested. Include Specification page and paragraph number.
  - 2. Identity of substitution including complete Product description, drawings, photographs, performance and test data; and all other information necessary for evaluation.
  - 3. Quality comparison of proposed substitution with specified Product.
  - 4. Changes in other Work required because of substitution.
  - 5. Effect on construction progress schedule.
  - 6. Cost of proposed substitution compared with specified Product.
  - 7. Any required license fees or royalties.
  - 8. Availability of maintenance service.
  - 9. Source of replacement materials.

## **1.2 SUBSTITUTIONS DURING BIDDING PERIOD**

- A. No request for substitution approval will be considered unless written request in duplicate has been submitted on Standard Form bound hereinafter, and has been received by Architect at least 5 Working Days prior to Subbid submission deadlines.
- B. Requests must be hand-delivered, faxed, electronically-mailed in PDF-format, or postal-mailed. *(Note: Neither faxed, electronically-mailed requests without automatic-read receipt request, nor postal-mailed requests submitted without self-addressed and stamped envelope will be individually acknowledged.)*
- C. Architect will issue Addenda prior to Subbid submission deadlines listing all approved substitutions.

(Cont.)

## SUBSTITUTION REQUEST

To: \_\_\_\_\_

Project: \_\_\_\_\_

Specified Item: \_\_\_\_\_

Specifications Section No.: \_\_\_\_\_ Page No.: \_\_\_\_\_ Para. (Line) No.: \_\_\_\_\_

Proposed Substitution Item: \_\_\_\_\_

Attached Data Includes:

1. Product description, specifications, photographs, drawings, performance data, and/or test data necessary for request evaluation.
2. Description of changes to Construction Documents that proposed substitution will require for proper installation.

The Undersigned hereby certifies that the following is correct, unless otherwise modified by included attachments:

1. Proposed substitution is equivalent or superior to specified item.
2. If proposed substitution should alter project design, dimensions, or installation requirements, the Undersigned will pay for any increased costs necessitated by substitution, including costs for additional engineering, drawing, and specifying.
3. Proposed substitution will have no adverse effect upon work of other trades, progress schedule, Code compliance, or warranty requirements.
4. Maintenance service and replacement products will be locally and readily available.

Additionally, the Undersigned hereby certifies that if this page is altered or modified, that the terms and requirements of the Contract Documents will remain unaltered or unmodified.

*(Print or type the following)*

Submitted by: \_\_\_\_\_

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

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

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

City, State, & Zip: \_\_\_\_\_

Phone: (\_\_\_\_) \_\_\_\_\_ Date: \_\_\_\_\_

*(If submitted after Contract award):*

Contractor's Signature: \_\_\_\_\_

Owner's Signature: \_\_\_\_\_

*(For use by design professional)*

\_\_\_\_ Approved \_\_\_\_ Approved as noted

\_\_\_\_ Not approved \_\_\_\_ Received too late

By \_\_\_\_\_

Date \_\_\_\_\_

Remarks \_\_\_\_\_

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

October 10, 2003



Advancement  
of Construction  
Technology

### **1.3 SUBSTITUTIONS AFTER CONTRACT AWARD**

- A. Approval will be granted only when recommended by Architect, when approved by Owner, and when:
  - 1. Specified Product cannot be delivered without Project delay, or
  - 2. Specified Product has been discontinued, or
  - 3. Specified Product has been replaced by superior Product, or
  - 4. Specified Product cannot be guaranteed as specified, or
  - 5. Specified Product will not perform properly, or
  - 6. Specified Product will not fit within designated space, or
  - 7. Specified Product does not comply with governing codes, or
  - 8. Substitution will be clearly in Owner's interest.
- B. If and when approved, Architect will issue Change Order for Owner's signature authorizing approved substitution and revising Contract Sum where appropriate.
- C. Owner will be entitled to deduct from the Contract Sum such amounts paid to Architect for evaluating Substitution Requests after Contract award, and to make agreed-upon changes to the Drawings and Specifications made necessary by Owner's acceptance of such substitutions.

### **1.4 CONTRACT COMPLIANCE**

- A. Substitution approval does not relieve Contractor from responsibility for proper execution of the Work and for compliance with other Contract requirements.

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 GENERAL**

- A. Owner has established that Project shall minimize creation of Jobsite Construction Waste.

**1.2 SECTION INCLUDES**

- A. Wherever practicable, Waste Materials produced as a result of this Project shall be:
1. Reused in Project Work, when so approved by Architect.
  2. Salvaged for reuse on some other project or for resale.
  3. Recycled as specified herein.

**1.3 RELATED SECTIONS**

- A. Materials & Equipment: Section 01-60-00  
B. Cleaning & Trash Removal: Section 01-71-00

**1.4 UNATTAINABLE GOALS**

- A. Identify any instance where compliance with requirements of this Specification does not appear practicable, and request resolution from Architect.

**1.5 REGULATORY AGENCY REQUIREMENTS**

- A. Comply with laws, ordinances, and regulations governing:
1. Handling of Hazardous, Toxic, and Contaminated Materials.
  2. Transporting of Waste Materials.

(Cont.)

## **PART 2 - PRODUCTS**

### **2.1 RECYCLABLE MATERIALS**

- A. The following Materials are presumed to be recyclable within the Project area:
1. Land-clearing Debris & Rubble
  2. Asphaltic Concrete
  3. Metals
  4. Clean Dimensional Wood & Pallet Wood
  5. Plywood, OSB, & Particleboard
  6. Roofing
  7. Gypsum Board (unpainted)
  8. Acoustic Tile
  9. Paint
  10. Glass
  11. Thermal & Acoustic Insulation
  12. Carpet
  13. Paper, Cardboard, & Packaging
  14. Plastic
  15. Beverage Containers

### **2.2 ON-SITE STORAGE CONTAINERS**

- A. Provide separate Storage Containers for each of the following:
1. Each type of Recyclable Material
  2. Salvage to be reused
  3. Salvage to be sold
  4. Hazardous, Toxic, and Contaminated Materials.
  5. Disposable Waste, Trash, and Debris.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Comply with applicable requirements of Recycling Facilities and Waste Processors.

### **3.2 PROTECTING WORK OF OTHER TRADES**

- A. Protect against damage and discoloration caused by Work of this Section.

**PART 3 - EXECUTION**

**3.3 SORTING & ON-SITE STORING**

- A. Segregate Waste Materials and store in Containers specified above.
- B. Do not permit Containers to overflow.
- C. Maintain Storage Area neat and orderly at all times.

**3.4 PREPARATION & RECONDITIONING OF RECYCLABLE WOOD**

- A. Remove all Nails, Bolts, and other Fasteners.
- B. Segregate Wood contaminated by Creosote, Asphalt, Oil, Preservatives, Lead Paint, or other Chemicals

**3.5 TRANSPORTING RECYCLABLE & DISPOSABLE MATERIALS**

- A. Comply with governing regulations.

**3.6 WORKER INSTRUCTIONS**

- A. Instruct on-site Workers about proper separating, handling, and recycling methods.

**3.7 CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion or sooner, if directed.

**END OF SECTION**



### **1.1 WORK INCLUDED**

- A. Provide Field Engineering required for Project, including the following:
  - 1. Layout Survey Work
  - 2. Civil, Structural, and other Engineering necessary to execute Contractor's construction methods.

### **1.2 WORK BY OWNER**

- A. Owner's Representative will, upon request, locate existing Control Points and Property Line Corners.

### **1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Summary of Work: Section 01-11-00
- B. Record Documents: Section 01-82-00

### **1.4 ENGINEER'S QUALIFICATIONS**

- A. Layout Surveyor: Oregon State-licensed Land Surveyor
- B. Engineers: Oregon State-licensed in specific service to be performed.

### **1.5 SURVEY REFERENCE POINTS**

- A. Existing Points: See Drawings
- B. Locate prior to starting Work, and preserve during construction.
- C. Make no changes to Existing Points without Architect's approval.
- D. Employ State-licensed Land Surveyor to replace any lost, destroyed, or relocated Points.

### **1.6 PROJECT LAYOUT**

- A. Establish Construction Bench Marks referenced to existing Control Points.
- B. Record Bench Mark locations, with horizontal and vertical dimensions, on Project Record Drawings
- C. Using Surveying Instruments establish lines and levels for the following:
  - 1. Site Improvements, including Paving.
  - 2. Stakes for grading, filling, and Topsoil placing.
  - 3. Utility slopes and invert elevations.
  - 4. Building Foundations, Floor, and Roof elevations.
  - 5. Wall and Column locations and similar Elements.
  - 6. Control lines and levels for Mechanical and Electrical Work.
- D. Periodically verify Layout accuracy.

**1.7 EQUIPMENT**

- A. Maintain the following at Project Site for Architect's use:
1. Laser Level
  2. Leveling Rod
  3. Plumb Bob
  4. 6 ft. & 10 ft. long Straight Edges
  5. 100 ft. long Measuring Tape or Laser Measuring Device

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Perform all cutting, fitting, and patching, including related excavation or backfill required to complete Work, and to:
  - 1. Make Work fit properly
  - 2. Integrate with other Work
  - 3. Uncover Work for installation of ill-timed Work
  - 4. Remove and replace defective and non-conforming Work
  - 5. Remove samples of installed Work for testing
  - 6. Provide penetrations through non-structural surfaces for Mechanical and Electrical Work

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Products similar to those specified elsewhere in this Project Manual:
  - 1. Follow those Specifications.
- B. Other Products:
  - 1. Follow Architect's instructions.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Inspect existing conditions and identify Work subject to damage or movement caused by proposed cutting and patching.
- B. After uncovering, inspect conditions affecting performance of Work.
- C. Report unsatisfactory and questionable conditions to Architect.
- D. Do not proceed with Work until Architect provides further instructions.

**3.2 PREPARATION**

- A. Maintain adequate Temporary Support necessary to assure structural integrity of affected Work.
- B. Protect other portions of Project Work against damage and discoloration.
- C. Protect Work exposed by cutting against damage and discoloration.

**PART 3 - EXECUTION**

**3.3 PERFORMANCE**

- A. Provide proper surfaces for patching and finishing.
- B. Employ qualified Installer or Fabricator to perform cutting and patching for:
  - 1. Weather-exposed or moisture-resistant surfaces.
  - 2. Sight-exposed finished surfaces.
- C. Cut Concrete and other Rigid Materials with Masonry Saw or Core Drill. Do not over-cut at Corners.
- D. Restore cut or removed Work with new Products to provide Work complete in accordance with Contract Documents. Maintain any original Fire-resistance Rating.
- E. Fit Work air-tight to Pipes, Sleeves, Ducts, Conduits, and other surface penetrations.
- F. Where patching occurs, refinish entire surface to provide even finish to match adjacent Work as follows:
  - 1. Continuous Surfaces: Refinish to nearest Intersection or Joint.
  - 2. Assemblies: Refinish entire Assembly.

**3.4 CUTTING STRUCTURAL FRAMING**

- A. Exposed Members:
  - 1. None permitted unless otherwise shown on Drawings or pre-approved.
- B. Concealed Light-gage Steel Framing Members:
  - 1. Flanges: Do not cut, notch, or drill.
  - 2. Webs: Cut or drill only in compliance with Framing Manufacturer's instructions.

**3.5 CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon work completion or sooner, if directed.

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 EXTENT OF WORK**

- A. As required by Contract Conditions and as specified herein, execute Cleaning and Trash removal during Work progress and at Work completion.

**1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Materials Recycling & Waste Management: Section 01-64-00
- B. Cleaning specific Products or Work: See respective Specification Sections.

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 REGULATORY AGENCY REQUIREMENTS**

- A. Comply with governing Codes, Regulations, Ordinances, and Antipollution requirements.

**PART 2 - PRODUCTS**

**2.1 CLEANING MATERIALS**

- A. Use only those which will not create hazards to health or property, and which will not damage Surfaces.
- B. Use only those recommended by Manufacturer of Surface to be cleaned.
- C. Use only on Surfaces recommended by Cleaning Material Manufacturer.

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. Follow Cleaning Material and Surface Manufacturers' instructions.

**PART 3 - EXECUTION**

**3.2 DURING CONSTRUCTION**

- A. Periodically, and when directed by Architect, clean to maintain Work, Site, and adjacent Properties free from accumulations of Waste, Rubbish, and Windblown Debris, resulting from Construction Operations.
- B. Provide on-site Containers for collection of Waste, Debris, and Rubbish.
- C. Periodically remove Waste, Debris, and Rubbish; and lawfully dispose of away from Project Site.

**3.3 DUST CONTROL**

- A. Clean Interior Surfaces prior to painting, and continue cleaning as needed until painting is complete.
- B. Schedule cleaning so that resultant Dust and Contaminants will not fall on wet or newly-coated Surfaces.

**3.4 FINAL CLEANING**

- A. Remove Waste, Debris, and Surplus Material from Project Site and Adjacent Property, and lawfully dispose. Do not bury on Project Site.
- B. Clean Grounds as follows:
  - 1. Paved Surfaces: Remove Stains, Spills, and Foreign Substances; and hose-clean.
  - 2. Other Surfaces: Rake-clean.
- C. In addition to debris-removal and cleaning specified in other Sections, clean exposed-to-view Exterior and Interior Surfaces.
- D. Employ skilled Workers to perform cleaning.
- E. Remove any Temporary Protection and Labels not required to remain.
- F. From sight-exposed Exterior and Interior Surfaces, remove Grease, Adhesive, Mastic, Dust, Dirt, Paint, Stains, Fingerprints, and other Foreign Substances.
- G. Clean Glazing, including any Mirrors.
- H. Polish Glossy Surfaces to clear shine.
- I. Vacuum-clean Carpet and similar Soft Materials.
- J. Clean Equipment Surfaces, and remove excess Lubricants.
- K. Clean and sanitize Appliances and Plumbing Fixtures.
- L. Ventilating System, if used during construction:
  - 1. Ducts, Blowers, Coils, Etc.: Clean
  - 2. Disposable Filters: Replace
  - 3. Permanent Filters: Clean
- M. Clean Lighting Fixtures and Lamps.
- N. Remove Waste, Debris, and Foreign Substances from Roof and Roof Drainage System.
- O. Maintain Structure and Components clean until Project Substantial Completion.

**PART 3 - EXECUTION**

**3.5 PROTECTING COMPLETED WORK**

- A. After cleaning, maintain temporary Door Mat and Disposable Booties adjacent to each Building Entrance, and post durable sign reading:

DO NOT ENTER BUILDING WITHOUT  
WEARING FLOOR-PROTECTION  
BOOTIES

**END OF SECTION**

**1.1 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS**

- A. Record Documents: Section 01-82-00
- B. Operating & Maintenance Data: Section 01-83-00
- C. Equipment: Div. 11
- D. Mechanical Requirements: See Mechanical Specifications
- E. Electrical Requirements: See Electrical Specifications

**1.2 ADVANCE NOTICES**

- A. Notify Architect's, Construction Manager's, and Owner's Representatives at least 5 working days prior to specified Tests and Inspections.

**1.3 GENERAL**

- A. Coordinate start up schedules for all Equipment and Systems.
- B. Verify that:
  - 1. Each piece of Equipment or System has been checked for proper Lubrication, Drive Rotation, Belt Tension, Control Sequence, and other Conditions which could damage Equipment or Systems.
  - 2. Tests, Meter Readings, and specified Electrical Characteristics agree with those required by Equipment or System Manufacturer.
  - 3. Equipment and Systems Wiring and Support Components are complete, and have successfully passed all required Tests.
- C. Submit copies of all required Inspections and Tests to Architect's, Construction Manager's, and Owner's Representatives.
- D. Certify in writing that Equipment and Systems are properly installed and correctly functioning.

**1.4 START UP REQUIREMENTS**

- A. Execute start up in accordance with Contract Specifications and Manufacturers' instructions.
- B. When so specified, require Manufacturers' authorized Representatives to inspect and approve Equipment and Systems prior to start up, and to supervise placing Equipment and Systems in operation.
- C. Adjust and balance Equipment and Systems prior to testing

(Cont.)



## **1.5 FUNCTIONAL TESTING**

- A. Comply with Specifications requirements.
- B. Perform required Tests in presence of Architect's, Construction Manager's, and Owner's Representatives.
- C. Conduct Tests under specified Design Operating Conditions.
- D. Tests shall clearly demonstrate that the Equipment and Systems comply with Specifications, including proper installation, adjustment, calibration, and connections.
- E. Perform Tests in the following sequence:
  - 1. Test Equipment individually.
  - 2. Test Equipment Subsystems separately.
  - 3. Test complete Systems.
  - 4. Test Interties with other Systems.
- F. Obtain Architect's, Construction Manager's, and Owner's written certification of acceptable Tests.
- G. Contractor shall furnish all required Testing Equipment and Materials.

## **1.6 PERFORMANCE TESTING**

- A. Immediately upon written acceptance of Functional Tests, operate Equipment and Systems for at least 30 consecutive days to demonstrate that Equipment and Systems comply with specified Performance Requirements.
- B. In event of Performance Test failure, immediately discontinue 30 day Test, make necessary repairs, adjustments, or replacements, and repeat 30 day Test.
- C. Satisfactory completion of 30 day Performance Test does not relieve Contractor of Contract Warranty requirements.
- D. Systems to be tested include, but are not limited to:
  - 1. Building Equipment
  - 2. Plumbing Systems
  - 3. Heating, Ventilating, & Air Conditioning Systems
  - 4. Control Systems
  - 5. Electrical Power Systems
  - 6. Lighting Systems
  - 7. Fire Suppression Systems
  - 8. Irrigation Systems

## **1.7 TESTING PROCEDURES APPROVAL**

- A. At least 30 calendar days prior to starting Tests, prepare and submit, for Architect's and Owner's approval, detailed description of Contractor's proposed Testing Procedures. Do not begin Tests until Procedures have been approved.

(Cont.)

### **1.8 DOCUMENTING TESTS**

- A. Contractor shall prepare Check-off Sheet(s) for each Component of each System.
- B. In addition to Test results, Check-off Sheets shall include the following:
  - 1. Project Name
  - 2. Equipment/System Item
  - 3. Tag Number
  - 4. Description
  - 5. Calibration
  - 6. Manufacturer & Model
  - 7. Installation Bulletin
  - 8. Specification Page and Paragraph Number
  - 9. Test Conductors' identities and signatures
  - 10. Space for Architect's and Owner's signature of acceptance

### **1.9 SUBMITTALS**

- A. Submit Test Reports to General Contractor for inclusion within Owner's Operation & Maintenance Manuals specified in Section 01-83-00.

**END OF SECTION**

## **1.1 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS**

- A. Cleaning & Trash Removal: Section 01-74-00
- B. Equipment & Systems Start Up: Section 01-75-00
- C. Warranties & Bonds: Section 01-78-00
- D. Record Documents: Section 01-82-00
- E. Operating & Maintenance Data: Section 01-83-00

## **1.2 SUBSTANTIAL COMPLETION INSPECTION**

- A. When Contractor considers Work substantially complete, as defined in General Conditions, Contractor shall submit to the Architect:
  - 1. Written notice that Work, or designated portion thereof, is substantially complete.
  - 2. List of Items to be completed or corrected.
- B. Architect will, as soon as possible thereafter, make inspection to determine completion status.
- C. If Architect should determine that Work is not substantially complete:
  - 1. Architect will promptly notify Contractor in writing, giving reasons therefore.
  - 2. Contractor shall remedy Work deficiencies, and send second notice of substantial completion to Architect.
- D. When Architect concurs that Work is substantially complete, Architect will:
  - 1. Prepare Certificate of Substantial Completion using AIA Document G704, accompanied with Contractor's list of items to be completed or corrected, as verified and amended by Architect.
  - 2. Submit Certificate to Owner and Contractor for their written acceptance of the responsibilities assigned to them in the Certificate.

## **1.3 FINAL INSPECTION**

- A. When Contractor considers Work complete, Contractor shall submit written certification that:
  - 1. Contract Documents have been reviewed.
  - 2. Contractor has inspected Work for compliance with Contract Documents.
  - 3. Work has been completed in accordance with Contract Documents.
  - 4. Equipment and Systems have been tested in presence of Owner's Representative and are operational.
  - 5. Work is complete and ready for final inspection.
- B. Architect will inspect Work to verify completion status as soon as possible after receipt of Contractor's Certification.
- C. If Architect should consider Work incomplete or defective:
  - 1. Architect will promptly notify Contractor in writing, listing incomplete or defective Work.
  - 2. Contractor shall immediately remedy deficiencies, and send second written certification to Architect that Work is complete.
  - 3. Architect will reinspect Work.
- D. When Architect finds Work acceptable under Contract Documents, Architect will request Contractor to make closeout submittals.

#### **1.4 REINSPECTION FEES**

- A. Architect will make 1 Substantial Completion Inspection to determine any Work Deficiencies and 1 Final Completion Inspection to ascertain that Deficiencies have been satisfactorily completed.
- B. If Architect should be required to make additional Inspections:
  - 1. Owner will compensate Architect for such additional services.
  - 2. Owner will deduct Architect's compensation amount from Contractor's final payment as follows:
    - a. Architect's time at current Billing Rates.
    - b. Architect's Employees' time at current Billing Rates.
    - c. Others at current Billing Rates
    - d. Charges will be made for necessary travel time, inspection time, and inspection report writing time; auto expense computed at 65 cents per mile; room and board; and all other expenses incurred in making inspections.

#### **1.5 EVIDENCE OF PAYMENTS & RELEASE OF LIENS**

- A. Contractor shall submit the following:
  - 1. Contractor's Affidavit of Payment of Debts and Claims, AIA Doc. G706.
  - 2. Contractor's Affidavit of Release of Liens, AIA Doc. G706A including the following:
    - a. Consent of Contractor's Surety, if any, to Reduction in or Partial Release of Retainage, AIA Doc. G707A.
    - b. Consent of Contractor's Surety, if any, to Final Payment, AIA Doc. G707.
    - c. Contractor's Release or Waiver of Liens.
    - d. Separate releases or waivers of lien for Subcontractors, Suppliers, and others with lien rights against Owner's Property, together with list of those parties.
- B. Sign and execute all Submittals, before delivery to Architect.

#### **1.6 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ARCHITECT**

- A. Certificate of Insurance for Products & Completed Operations: See Contract Conditions
- B. Wage Certification: See Contract Conditions
- C. Project Record Documents: See Section 01-82-00
- D. Owner's Operating & Maintenance Manual: See Section 01-83-00
- E. Certificate of Domestic Water Disinfection
- F. Building Official's Certificates of Inspections
- G. Building Official's Certificate of Occupancy

(Cont.)

**1.7 SPARE PARTS & MAINTENANCE MATERIALS SUBMITTALS TO OWNER**

- A. Specific Requirements: See Specification Sections
- B. Products: Identical to those included in Project Work
- C. Storage Location: On Project premises where directed by Owner
- D. Required Submittals:
  - 1. Extra Acoustic Tile: See Section 09-50-00
  - 2. Extra Resilient Floor Covering: See Section 09-65-00
  - 3. Extra Carpet: See Section 09-68-00
  - 4. Extra Paint: See Section 09-90-00
  - 5. Extra Wall Covering: See Section 09-95-00
  - 6. Extra Fire Suppression Equipment: See Fire Suppression Specifications
  - 7. Extra Plumbing Equipment: See Plumbing Specifications
  - 8. Extra HVAC Equipment: See HVAC Specifications
  - 9. Extra Electrical Equipment: See Electrical Specifications
  - 10. Extra Irrigation Equipment: See Div. Irrigation Specifications
  - 11. Others required by Specifications

**1.8 DEMONSTRATIONS**

- A. Instruct Owner in operation of all Systems and Equipment in accordance with Section 01-83-00.

**1.9 FINAL ADJUSTMENT OF ACCOUNTS**

- A. Submit final statement of accounting to Architect, including the following:
  - 1. Original Contract Sum
  - 2. Additions and deductions resulting from:
    - a. Previous Change Orders
    - b. Other adjustments
    - c. Deductions for uncompleted Work
    - d. Deductions for any Liquidated Damages
    - e. Deductions for Reinspection Payments
  - 3. Total Contract Sum, as adjusted
  - 4. Previous payments
  - 5. Sum remaining due
- B. Architect will prepare and issue final Change Order, reflecting approved adjustments to Contract Sum not previously made by Change Orders.

**1.10 FINAL APPLICATION FOR PAYMENT**

- A. Follow procedures specified in Section 01-29-50.

**END OF SECTION**

### **1.1 REQUIREMENTS INCLUDED**

- A. Compile specified Bonds, if any, and Warranties.
- B. Compile specified Service and Maintenance Contracts.
- C. Review Submittals to verify compliance with Contract Documents.

### **1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS**

- A. Bid Bond: See Procurement Requirements
- B. Performance & Labor & Material Payment Bonds: See Contract Conditions
- C. General Warranty for Construction: See Contract Conditions
- D. Contract Closeout: Section 01-77-00
- E. Operating & Maintenance Data: Section 01-83-00
- F. Warranties or Bonds required for Specific Products: See respective Specification Sections

### **1.3 REQUIRED SUBMITTALS**

- A. Assemble Bonds, Warranties, and Service & Maintenance Contracts executed by Contractor, and each of respective Manufacturers, Suppliers, and Subcontractors.
- B. Number of Original Signed Copies Required: Provide 1 for each volume of Owner's Operating & Maintenance Manual specified in Section 01-83-00.
- C. Table of Contents: Neatly type in orderly sequence.
- D. Provide complete information for each of the following:
  - 1. Product or Work Item
  - 2. Firm, with name of Principal, Address, and Telephone Number
  - 3. Beginning date and duration of Bond, Warranty, or Service & Maintenance Contract.
  - 4. The following information for Owner's Personnel:
    - a. Procedure in event of failure or malfunction.
    - b. Instances which affect Bond, Warranty, or Service & Maintenance Contract.
  - 5. Contractor, name of responsible Principal, Address, and Telephone Number.

### **1.4 SUBMITTAL FORM**

- A. Pages Size: 8-1/2 x 11 inches
- B. Fold larger sheets to fit into Binder.
- C. Cover: Identify each Packet with printed title "WARRANTIES & BONDS".
- D. List:
  - 1. Title of Project
  - 2. Name of Contractor
- E. Punch sheets for standard 3-ring Binder.

**1.5 SUBMITTAL LOCATION**

- A. Bind into Owner's Operating & Maintenance Manuals specified in Section 01-83-00.

**1.6 SUBMITTAL TIME**

- A. See Section 01-83-00.

**1.7 MANUFACTURERS' WARRANTIES**

- A. In addition to Contractor's Warranty, Manufacturers' Warranties shall pass to Owner and shall not take effect until affected Work has been accepted in writing by Owner.

**END OF SECTION**

## **1.1 GENERAL**

- A. Maintain at Project Site for Owner, 1 record copy of:
  - 1. Contract Drawings & Specifications
  - 2. Addenda
  - 3. Change Orders & other Contract Modifications
  - 4. Field Orders & other Written Instructions
  - 5. Approved Shop Drawings, Product Data, & Samples.
  - 6. Field Test Reports

## **1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS**

- A. Shop Drawings, Product Data, & Samples: Section 01-33-00
- B. Operating & Maintenance Data: Section 01-83-00

## **1.3 MAINTENANCE OF DOCUMENTS & SAMPLES**

- A. Store in Contractor's Field Office apart from Documents used for Construction.
- B. Provide Files, Shelving, and Cabinets necessary to safely and securely store Documents and Samples.
- C. Maintain Documents clean, dry, legible, and in good order.
- D. Do not use Record Documents for Construction purposes.
- E. Make Documents available at all times for Architect's inspection.
- F. Architect will monitor Record Documents during each Jobsite visit. Up-to-date Record Documents are prerequisite to acceptance and approval of Payment Application.

## **1.4 DRAFTER'S QUALIFICATIONS**

- A. Drafting must be accurate and legible.
- B. If Architect deems submitted Drafting to be unacceptable, redraft until acceptable at no additional cost to Owner.

## **1.5 WORK SET MARKING DEVICES**

- A. Type: Waterproof soft-tip
- B. Color Code, unless otherwise directed or approved:
  - 1. Green: Document changes
  - 2. Red: Work deleted
  - 3. Other Contrasting Color: Revised Dimensions and other Notations



## **1.6 RECORD DRAWINGS**

- A. Maintain 1 complete digital-set of Contract Drawings to record all Contract changes.
- B. Show actual conditions where installation varies substantially from Work shown on Drawings. Give particular attention to Concealed Work that would be difficult or impossible to record at later date. Record location of Backing and other Concealed Items required for installation of Future Work.
- C. Mark whichever Contract Drawing or Shop Drawing is most appropriate and most capable of accurately and clearly showing actual "field conditions". Where Shop Drawings are used to record changes, record cross-reference on appropriate Contract Drawing.
- D. Where applicable, indicate Change Order numbers with each Change.
- E. Indicate related Specification or Product Data revisions, where applicable.
- F. Upon Work completion, submit digital-copy to Architect for forwarding to Owner.
- G. Contractor may retain Work-set for Contractor's Records.

## **1.7 RECORD SPECIFICATIONS**

- A. Maintain 1 complete copy of Project Manual including Specifications; any Addenda; and other Written Documents such as Change Orders, Supplemental Instructions, and similar written Modifications issued during course of Work.
- B. Mark Documents to show actual conditions where installation varies substantially from specified Work. Give particular attention to Concealed Work that would be difficult or impossible to record at later date.
- C. Indicate related Record Drawing and Product Data revisions, where applicable.

## **1.8 RECORD PRODUCT DATA**

- A. Maintain 1 copy of each Product Data submittal.
- B. Mark documents to show actual conditions where installation varies substantially from Contract Specifications or Drawings. Include any variations in installed Products or in Manufacturer's installation instructions. Give particular attention to Concealed Work that would be difficult or impossible to record at later date.
- C. Indicate related Record Drawing and Specifications revisions, where applicable.

## **1.9 RECORD SAMPLES**

- A. Immediately prior to Substantial Completion date, Contractor shall coordinate with Architect to determine which, if any, Contractor-maintained Samples shall be submitted for Owner's permanent record.

### **1.10 RECORDING**

- A. Label each Document "PROJECT RECORD" in neat, large, printed letters.
- B. Record Information concurrently with Construction progress.
- C. Do not conceal any Work until required Information is recorded.
- D. Legibly mark Drawings to record the following Actual Construction:
  - 1. Depth of Foundation Elements in relation to adjacent Ground Floor elevation.
  - 2. Horizontal and Vertical Locations of Underground Utilities and Appurtenances, referenced to permanent Surface Improvements.
  - 3. Location of Internal Utilities and Appurtenances concealed in Construction, referenced to visible and accessible Features of Structure.
  - 4. Field Changes of Dimensions and Details.
  - 5. Changes made by Change Order or Field Order.
  - 6. Details not shown on original Contract Drawings.
- E. Legibly mark Specifications and any Addenda to record the following:
  - 1. Manufacturer, Trade Name, Catalog Number, and Supplier of each Product actually installed.
  - 2. Changes made by Change Order or Field Order.

### **1.11 SUBMITTAL**

- A. Organize Record Documents into manageable Sets, including Cover Sheet for each Set indicating the following:
  - 1. Project title
  - 2. Date
  - 3. Contractor's Name & Address
  - 4. Title and number of each Record Document
  - 5. Name of Person who prepared Sheet
  - 6. Signature of Contractor or his authorized Representative
- B. Submission Method:
  - 1. Submit Digital-copy to Architect for forwarding to Owner.

**END OF SECTION**

## **1.1 GENERAL**

- A. Compile Product Data and related Information appropriate for Owner's maintenance and operation of Products furnished under Contract.
- B. Prepare as specified herein and in other Specification Sections.
- C. Instruct Owner's Personnel in maintenance of Products and in operation of Equipment and Systems.

## **1.2 RELATED REQUIREMENTS SPECIFIED IN OTHER SECTIONS**

- A. Shop Drawings, Product Data, & Samples: Section 01-33-00
- B. Equipment & Systems Start Up: Section 01-75-00
- C. Contract Closeout: Section 01-77-00
- D. Warranties & Bonds: Section 01-78-00
- E. Project Record Documents: Section 01-82-00

## **1.3 QUALITY ASSURANCE**

- A. Data preparation shall be done by Personnel:
  - 1. Trained and experienced in maintenance and operation of described Products.
  - 2. Completely familiar with requirements of this Section.
  - 3. Sufficiently skilled as Technical Writer to communicate essential data.
  - 4. Sufficiently skilled as Drafter to competently prepare required Drawings.

## **1.4 MANUAL CONTENT - GENERAL**

- A. Neatly typewritten Table of Contents for each Volume, arranged in systematic order.
- B. List:
  - 1. Contractor, name of responsible Principal, address, and telephone number.
  - 2. Each Product including name, address, and telephone number of:
    - a. Subcontractor or Installer
    - b. Recommended Maintenance Contractor
    - c. Local source for Replacement Parts
  - 3. Product name and other Identifying Symbols as set forth in Contract Documents.
- C. Product Data:
  - 1. Include only those Sheets which are pertinent to specific Product.
  - 2. Annotate each Sheet to:
    - a. Clearly identify specific Product or Part installed.
    - b. Clearly identify Data applicable to installation.
    - c. Delete references to inapplicable Data.

(Cont.)

#### **1.4 MANUAL CONTENT - GENERAL (Cont.)**

- D. Drawings:
  - 1. Supplement Product Data with Drawings where necessary to clearly illustrate:
    - a. Relations of Component Parts
    - b. Control and Flow Diagrams
  - 2. Do not use Project Record Documents as Maintenance Drawings.
- E. Written Text:
  - 1. Provide where necessary to supplement Product Data and Drawings.
  - 2. Write all text in English.
  - 3. Organize in consistent format under separate headings for different procedures.
  - 4. Provide logical sequence of instructions for each procedure.
- F. Warranties, Bonds, & Maintenance Contracts:
  - 1. Provide copy of each.
  - 2. Include the following:
    - a. Proper procedures in event of failure.
    - b. Instances which might affect validity of Warranties, Bonds, or Contracts.

#### **1.5 MANUAL FOR ARCHITECTURAL MATERIALS & FINISHES**

- A. Include the following Manufacturer's data:
  - 1. Catalog Number, Size, & Composition.
  - 2. Color & Texture designations.
  - 3. Required Reordering Information.
  - 4. Recommended Cleaning Materials & Methods.
  - 5. Cautions against detrimental Cleaning Materials & Methods.
  - 6. Recommended Cleaning & Maintenance Schedule.
- B. Submit specified information for the following:
  - 1. Ornamental Metals: Section 05-70-00
  - 2. Special Doors: Section 08-30-00
  - 3. Overhead Doors: Section 08-36-00
  - 4. Aluminum Entrance & Window Systems: Section 08-40-00
  - 5. Door Hardware: Section 08-71-00
  - 6. Acoustic Tile: Section 09-50-00
  - 7. Resilient Flooring: Section 09-65-00
  - 8. Carpet: Section 09-68-00
  - 9. Seamless Epoxy Flooring: Section 09-72-00
  - 10. Painting & Finishing: Section 09-90-00
  - 11. Wall Covering: Section 09-95-00
  - 12. Visual Display Boards: Section 10-10-00
  - 13. Toilet Compartments: Section 10-16-00
  - 14. Operable Partitions: Section 10-65-00
  - 15. Toilet Accessories: Section 10-80-00
  - 16. Landscaping: Division 32

## **1.6 MANUAL FOR WEATHER PROTECTION MATERIALS**

- A. Include the following Manufacturer's data:
  - 1. Instructions for Inspection, Maintenance, & Repair.
- B. Submit specified information for the following Products:
  - 1. Metal Roof & Wall Panels: Section 07-41-00
  - 2. Phenolic Wall Panels: Section 07-43-00
  - 3. Single Ply Roofing: Section 07-53-00
  - 4. Sheetmetal Roofing: Section 07-61-00
  - 5. Sheetmetal Flashing & Trim: Section 07-62-00
  - 6. Roof Accessories: Section 07-72-00
  - 7. Joint Sealants: Section 07-92-00
  - 8. Plastic Skylights: Section 08-62-00
  - 9. Translucent Plastic Panels: Section 08-64-00

## **1.7 MANUAL FOR MECHANICAL EQUIPMENT & SYSTEMS**

- A. Include the following Manufacturer's data:
  - 1. Description of Unit and Component Parts including:
    - a. Function, normal operating characteristics, and limiting conditions.
    - b. Performance curves, engineering data, and tests.
    - c. Complete nomenclature and commercial number of replaceable parts.
  - 2. Operating procedures including:
    - a. Start-up, break-in routine, and normal Operating Instructions.
    - b. Regulation, control, stopping, shut-down, and emergency instructions.
    - c. Summer and winter operating instructions.
    - d. Special operating instructions.
  - 3. Maintenance procedures including:
    - a. Routine operations.
    - b. Trouble-shooting guide.
    - c. Disassembly, repair, and reassembly.
    - d. Alignment, adjusting, and checking.
    - e. Servicing schedule, filter-replacement schedule, and lubricating schedule including recommended Lubricants.
  - 4. Manufacturer's printed operating and maintenance instructions.
  - 5. Control Systems operation sequences.
  - 6. Parts list, illustrations, assembly drawings, and diagrams necessary for maintenance, including:
    - a. Life expectancy of Parts subject to wear.
    - b. Items recommended to be stocked as Spare Parts.
  - 7. As-installed Control Systems diagrams.
  - 8. Color-Code Legend, if any.
  - 9. Valve Tag Number Chart, with location and function of each Valve.

(Cont.)

**1.7 MANUAL FOR MECHANICAL EQUIPMENT & SYSTEMS (Cont.)**

- B. Submit specified information for the following:
1. Irrigation Equipment
  2. Plumbing Equipment
  3. HVAC Equipment
  4. Other specified Mechanical Equipment

**1.8 MANUAL FOR ELECTRICAL EQUIPMENT & SYSTEMS**

- A. Include the following Manufacturer's data:
1. Description of unit and component parts including:
    - a. Function, normal operating characteristics, and limiting conditions.
    - b. Performance curve, engineering data and tests.
    - c. Complete nomenclature and commercial number of replaceable parts.
  2. Panelboard Circuit Directories indicating:
    - a. Electrical service.
    - b. Controls.
    - c. Communications, if any.
  3. As-installed wiring Color-Code Legend, if any.
  4. Operating procedures, including:
    - a. Routine and normal operating instructions.
    - b. Sequences required.
    - c. Special operating instructions.
  5. Maintenance procedures including:
    - a. Routine operations.
    - b. Trouble-shooting guide.
    - c. Disassembly, repair, and reassembly.
    - d. Adjustment and checking.
  6. Manufacturer's printed operating and maintenance instructions.
  7. Parts List, including current prices, and recommended spare parts to be maintained in storage.
- B. Submit specified information for the following:
1. Appliances
  2. Lighting Fixtures
  3. Hoist Equipment
  4. Other specified Electrical Equipment

**1.9 ADDITIONAL DATA**

- A. Prepare and include the following:
1. Additional data when need becomes apparent during instruction of Owner's personnel.
  2. Additional data specified in other Sections of Specifications to be included.

**1.10 SUBMITTAL SCHEDULE**

- A. Submit to Architect in final form, 1 paper-copy of complete data at least 15 days prior to Final Completion Inspection.
- B. Copy will be returned with comments.
- C. Within 10 days following Final Inspection, digitally-submit to Architect for forwarding to Owner, corrected-copy in approved final form.

**1.11 INSTRUCTION OF OWNER'S PERSONNEL**

- A. Prior to Final Project Acceptance, instruct Owner's personnel in necessary operation, adjustment, and maintenance of Products, Equipment, and Systems.
- B. Operating & Maintenance Data specified herein shall be used as Training Manual. Trainers shall review Manual contents with Owner's Personnel in detail as required to clearly explain all aspects of Equipment and Systems operation and maintenance.
- C. Training:
  - 1. Location: At Project Site.
  - 2. Training shall be performed by experienced and Factory-trained Personnel, whose qualifications shall be approved by Architect and Owner prior to start of Training period.
  - 3. Training shall continue until Owner decrees that Personnel are adequately trained.
  - 4. For Owner's future use, provide Owner with computer-viewable Video Recording complete with Audio Sound Track of all Training Sessions. Recording need not be prepared by professional Videographer, but presentation quality must be acceptable to Owner and be suitable for intended purpose.
  - 5. At least 48 hours prior to Training Meeting, notify Architect of Meeting time and location.

**END OF SECTION**

### **1.1 SUB-SURFACE SOIL INVESTIGATION REPORT**

- A. The following Report, prepared for this Project, is available for review and reference:
  - 1. Title: Oregon Manufacturing Information Center
  - 2. Project Number: 07041279
  - 3. Dated: January 10, 2014
  - 4. Geotechnical Engineer:
    - a. Firm Name: PSI Intertek
    - b. Address: 6032 N. Cutter Circle - Suite 480 - Portland, OR 97217
    - c. Telephone Number: (503) 289-1778
- B. Report can be reviewed at the following locations:
  - 1. Geotechnical Engineer's Office
  - 2. Contractor's Office

### **1.2 OWNER'S DISCLAIMER**

- A. The Report is not part of the Contract Documents. It is made available for information only.
- B. The Owner does not guarantee Report Information accuracy at locations and times other than those given. Groundwater elevations, particularly, are subject to change.
- C. The Contractor shall assume responsibility for any conclusions the Contractor may draw from this Report. The Contractor may employ its own consultants to analyze this information and/or conduct additional tests and examinations.
- D. The Owner specifically disclaims responsibility for interpretations by any Bidder of information included within the Report.

### **1.3 DIFFERENT CONDITIONS**

- A. If, during construction, conditions are encountered which differ substantially from those indicated in the Report, promptly so notify the Architect in writing, and do not disturb such conditions until directed.
- B. The Architect will promptly request the Owner to instruct the Geotechnical Engineer to investigate such conditions.
- C. If the Geotechnical Engineer determines that conditions do differ substantially from those that reasonably could be anticipated from examination of the Site and the Report, and that such conditions will necessitate a change in the Work and/or an adjustment of the Contract Sum and/or the Contract Time, the Owner will authorize a Change Order, as stipulated in the General Conditions, to enable the necessary changes and/or adjustments.

**END OF SECTION**



**EARTHWORK****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 RELATED INFORMATION SPECIFIED IN OTHER SECTIONS**

- A. Geotechnical Data: Section 02-10-00
- B. Utility Trenching: Section 02-31-50
- C. Base Rock under Asphalt Pavement: Section 02-74-00
- D. Vapor Barrier under Concrete Flatwork: Section 03-30-00
- E. Landscape Soil Preparation & Planting: Division 32

**1.3 WORK INCLUDED, BUT REIMBURSED BY OWNER**

- A. Should Rock as defined below be encountered, other than any shown in Geotechnical Report, or any shown on Drawings, or any exposed to view during Bidding Period, Owner will pay extra for any necessary Rock removal and take credit for omitted Earth excavation, in accordance with Contract Conditions.
- B. Should Unstable Soil as defined below or excessive Water be encountered, other than any shown in Geotechnical Report, or any shown on Drawings, or any exposed to view during Bidding Period, Owner will pay extra for necessary site dewatering or soil removal, in accordance with Contract Conditions. Owner will not pay for removal or dewatering of Unstable Soil caused by reasonably anticipated inclement weather or by Contractor's work at the Site.
- C. Should Wells, Cisterns, Tanks, Cesspools, Garbage Pits, Foundations, Rubble, etc. be encountered, other than any shown on Geotechnical Report, or any shown on Drawings, or any exposed to view during Bidding Period, Owner will pay extra for any necessary removal and take credit for omitted Earth excavation, in accordance with Contract Conditions.

**1.4 DEFINITIONS**

- A. Rock:
  - 1. Boulders larger than 1 cu. yd. or Material that requires Splitting, Drilling, Blasting or other Specialized Equipment for removal.
- B. Unstable Soil:
  - 1. Soft, loose, or wet Ground that is incapable of supporting Material, Equipment, Personnel, or Structure.

(Cont.)

**EARTHWORK****PART 1 - GENERAL****1.4 DEFINITIONS (Cont.)**

- C. Unsuitable Fill Material:
  - 1. Soil with more than 2% Organic Fragments by volume, and/or with more than Optimum Moisture Content for compaction, and/or with Debris.
- D. AASHTO:
  - 1. American Association of State Highway and Transportation Officials, 341 National Press Building, Washington, D.C., 20004
- E. Weed-free:
  - 1. Material containing less than 5 objectionable Weeds per 100 sq. ft. Weeds include Dandelion, Jimsonweed, Quack Grass, Horsetail, Mustard, Canadian Thistle, Morning Glory, Rush Grass, Lambs Quarter, Chickweed, Cress, Crabgrass, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, and any other similar objectionable growth.

**1.5 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.6 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.7 SOIL BEARING TESTS**

- A. Should Contractor doubt Bearing Capacity of existing Soil, tests at Owner's expense may be ordered by Architect.

**1.8 REGULATORY AGENCY REQUIREMENTS**

- A. Comply with City's Dust, Erosion, and Sediment control requirements.

**1.9 ADVANCE NOTICES**

- A. Notify Testing Lab and Geotechnical Engineer at least 24 hours prior to completion of Excavation Work and Compaction Work so inspections can be made.

**EARTHWORK****PART 2 - PRODUCTS****2.1 GRAVEL**

- A. Material: Round; water-worn; washed; sound; durable Rock which is free of soft, friable, thin, elongated, or laminated Pieces; disintegrated Material; organic Matter; Oil; Alkali; or other Deleterious Substances.  
Maximum Size: See Filling under PART 3 - EXECUTION
- B. Minimum Size: 5% maximum passing #200 Sieve
- C. Gradation: Even

**2.2 CRUSHED ROCK**

- A. Material: Washed; sound; durable Rock which is free of soft, friable, thin, elongated, or laminated pieces; disintegrated Material; organic Matter; Oil; Alkali; or other Deleterious Substance.
- B. Shape: Mechanically crush as follows:
  - 1. Fracture at least 70% of Particles on at least 2 Faces.
  - 2. Maximum Unfractured Particles:
    - a. 3/8 inch and larger Rock: 10%
    - b. Smaller than 3/8 inch Rock: 5%Maximum Size: See Filling under PART 3 - EXECUTION
- C. Minimum Size: 5% maximum passing #200 Sieve
- D. Gradation: Even

**2.3 NATIVE MATERIAL**

- A. Existing Soil excavated from Project Site and stockpiled on Project Site for future use.
- B. Where reused in Planting Beds:
  - 1. Native Material shall contain Natural Friable Soil, 5% (max.) Rock-content, and 2 inch (min.) clean Organic Compost.
  - 2. Native Topsoil shall be reasonably free of Weeds, Litter, Subsoil, Clay, Lumps; similar Objects larger than 1 inch in greatest dimension; excess Acid or Alkali; and any other Substance that could be harmful to Plant-growth or hinder subsequent smooth-grading.

**2.4 IMPORTED LOAM**

- A. Material: Fertile, friable, natural, native of locality, and reasonably free of Subsoil, Clay, Silt, Stones, Lumps, Plants, Roots, Sticks, Weeds, Seeds, and other Extraneous Matter.
- B. Minimum Loam: 70%
- C. Minimum Organic Compost: 30%

**PART 2 - PRODUCTS**

**2.5 COMPACTION EQUIPMENT**

- A. Type: Contractor's choice, but appropriate for conditions of use.
- B. Caution: Within 3 ft. of Walls or Curbs use only small, manually-guided Compactors.

**2.6 GROUND STABILIZATION FABRIC**

- A. Manufacturer: Amoco, or approved.
- B. Type: Propex 2002
- C. Extent of Work: Provide where shown on Drawings.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Prior to starting Work of this Section, verify that Site Clearing has been properly completed and that existing Grades agree with Drawings.
- B. Notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.
- D. Should any suspected Contaminated Soil be encountered perform the following:
  - 1. Immediately notify Architect and Dept. of Environmental Quality.
  - 2. Comply with Architect's directions and Regulatory Agency requirements.
  - 3. Perform no Work that could disturb or spread suspected Contaminated Soil.
  - 4. Owner will employ and pay Testing Lab to confirm presence of Contaminated Soil.
  - 5. If Laboratory Tests confirm presence of Contaminated Soil, Owner will remove Contaminated Soil and will issue Change Order increasing Contract Sum for any proven additional cost to the Contractor and extending Contract Completion Date for any proven Contractor's lost time.

**3.2 SOIL BEARING TESTS**

- A. Should Contractor doubt Bearing Capacity of Existing Soil, Tests at Owner's expense may be ordered by Architect.

(Cont.)

**EARTHWORK****PART 3 - EXECUTION****3.3 PROTECTION**

- A. Monuments:
  - 1. Carefully maintain Bench Marks, Monuments, and other Reference Points.
  - 2. If disturbed or destroyed, replace as directed.
- B. Existing Utilities:
  - 1. Comply with requirements specified in Section 01-11-00.
- C. Traffic Control:
  - 1. Unless otherwise approved by Governing Authorities, provide necessary Barricades, Detours, Warning Devices, Flaggers, and coordinate Equipment movement to maintain Vehicle and Pedestrian Traffic on Public and Private Streets, Drives, and Walks.
- D. Erosion, Silt, & Sediment Control:
  - 1. In compliance with requirements of Dept. of Environmental Control (DEQ) and other Governing Agencies, prevent Eroded Material, Silt, and Sediment against entering into any Watercourse or Storm Drain, and onto any adjacent Property.
- E. Street Cleaning:
  - 1. Maintain Public and Private Streets and Walkways clean and Drains open at all times.
- F. Dust Control:
  - 1. Protect Persons and Property against damage and discomfort caused by Dust; dampen where necessary to settle Dust and where directed.
- G. Existing Trees to remain:
  - 1. Protect against damage in accordance with Section 01-56-00.
- H. Work of this Section:
  - 1. Except under Pavement and Walkways, protect Graded Material against damage and compaction from Traffic.
  - 2. Provide necessary Slopes and Ditches to drain Site during construction.
- I. Other Work and Adjacent Property:
  - 1. Protect against damage and discoloration caused by work of this Section.

**3.4 CUTTING EXISTING PAVEMENT, IF ANY**

- A. Cut, prior to excavating, with vertical, straight-line Joints using Pavement Saw or other Tool designed for cutting Pavement.
- B. Make Cuts parallel or perpendicular to Pavement centerline.
- C. Pavement Cut Width: Extend Cut 1 ft. beyond each side of Excavation.
- D. Replace Pavement to condition at least as good as existing prior to cutting. Comply with Project Specifications.

(Cont.)

**EARTHWORK****PART 3 - EXECUTION****3.5 EXCAVATION**

- A. After Site Clearing Work is completed, but before excavating:
1. Remove from Topsoil any Vegetation, Sticks, Clods, Rocks larger than 1-1/2 inches, excessive Gravel, Subsoil, or Debris.
- B. Excavating:
1. Excavate with square-edge Buckets as necessary for Work shown on Drawings or specified.
  2. Allow ample space for Concrete Formwork and Utility Trenching.
  3. Do not weave, pump, rut, or otherwise disturb Excavated Grade Surfaces with Equipment.
  4. Protect any Excavation Slopes with securely anchored Plastic Sheeting. Install as soon as practical following excavation, and maintain as long as necessary to prevent Soil erosion.
  5. Remove any Disturbed Material and replace with Compacted Fill at no additional cost to Owner.
  6. Leave Bearing Surfaces undisturbed, level, and true. Where necessary, compact as specified below.
- C. Blasting:
1. None permitted.
- D. Depth of Excavation:
1. Excavate to elevations no higher than shown on Drawings.
  2. Notify Architect if adequate Soil Bearing is not reached.
  3. Drawings indicate Contract Quantities; adjustments for variations will be made in accordance with General Conditions.
- E. Temporary Stockpiling of Excavated Material:
1. Locate within Construction Area.
  2. Unless otherwise approved, do not obstruct Private or Public Streets, Drives, Walkways, or Parking Areas.
  3. Locate sufficiently far from Excavation edges to prevent Stockpiled Material from falling into Excavation, and as required to eliminate effect on Excavation stability.
  4. At Stockpiles remaining during Rainy Periods, grade and cover Stockpile as required to prevent Compaction, Erosion, and Water Infiltration.
  5. Unless otherwise indicated, stockpiling Topsoil is not required if Topsoil can be distributed directly to final position.
- F. Excess Excavation:
1. Where Excavation, through Contractor's error, is carried to levels lower than those shown on Drawings, fill to proper levels at Contractor's expense as follows:
    - a. Under Footings: Fill with Concrete as specified in Section 03-30-00. Earth Fill or Gravel Fill under Footings not permitted.
    - b. Under Paving, Concrete Floor Slabs, & Walkways: Fill with compacted Gravel or Crushed Rock.
    - c. Elsewhere: Fill with Imported Loam
- (Cont.)

**EARTHWORK****PART 3 - EXECUTION****3.5 EXCAVATION (Cont.)**

- G. Shoring:
  - 1. Brace, shore Sides, or increase width of Excavations as necessary to prevent Cave-ins.
  - 2. Repair any Slides or Cave-ins.
  - 3. Remove Shoring before Backfilling.
- H. Water, Snow, Ice, & Frost:
  - 1. Keep Bearing under Footings dry and free of Snow, Ice, and Frost.
  - 2. Provide and operate Pumping Equipment necessary to keep Excavations free from Standing Water. Do not reduce adjacent Ground Water level to extent that could endanger or damage adjacent Structures or Property.
  - 3. Do not create "quick" condition or affect Soil Bearing Capacity.
  - 4. Do not discharge "removed" Water into permanent on-site Utilities or Trenches without Sediment Control.
  - 5. If Bearing Surfaces are softened by Water, Snow, Ice, or Frost, re-excavate to Solid Bearing and fill at Contractor's expense with Concrete as specified in Section 03-30-00.

**3.6 EXCESS OR SHORTAGE OF EARTH**

- A. Remove from Site excess Material and Material unsuitable for filling.
- B. Provide additional Material herein specified or needed for Fills.

**3.7 GROUND STABILIZATION FABRIC INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Prior to placing Fill, cover Fabric with 1 inch thick layer of Sand.

**3.8 PROOF-ROLLING SUBGRADE**

- A. Following Subgrade preparation and within 24 hours prior to Fill or Base Course placement, proof-roll Subgrade beneath Building and Pavement Areas with fully-loaded Water Tank Truck or 10 to 12 cu. yd. Dump Truck.
- B. If any areas pump, weave, or appear soft, immediately notify Architect and Owner's Geotechnical Engineer about encountered conditions. Unless otherwise directed and at no additional cost to Owner, over-excavate areas 12 inches minimum, and fill with Crushed Rock compacted as specified below.
- C. If more than 30 calendar days has passed between completion of Fill-placement and Construction-start, if Vehicle Traffic has been routed across area, or if Adverse Weather has occurred since Proof-rolling, repeat Proof-rolling specified above.

**EARTHWORK****PART 3 - EXECUTION****3.9 FILLING****A. General:**

1. Before proceeding, remove any Snow, Ice, Frozen Material, Debris or Decayable Matter from areas to be filled.
2. To insure bond, scarify any Sloping Ground to receive Fill.
3. Make Fills as soon as feasible to assure thorough settlement.
4. Uniformly place Fills adjacent to Structures to prevent unbalanced loading.
5. Place Fills in the following maximum loose-lift thicknesses:
  - a. Where Compacted with Heavy Equipment Compactors: 8 inches
  - b. Where Compacted with Hand-operated Compactors: 4 inches

**B. Fills directly under Concrete Flatwork:**

1. Base Course:
  - a. Material: Crushed Rock
  - b. Size: 3/4 inch to 1-1/2 inches
  - c. Maximum Fines: 10 %
  - d. Thickness: Fill space between underside of Leveling Course above and existing Subgrade below.
  - e. Maximum Lifts: 12 inches
2. Leveling Course:
  - a. Material: Gravel
  - b. Maximum Size: 3/4 inch
  - c. Thickness: 6 inches

**C. Fills beneath Sloping Concrete Flatwork & Asphalt Pavement:**

1. Slope Fill to prevent reducing Concrete and Asphalt thicknesses.

**D. Fills Against Walls:**

1. Fill with 1-1/2 inch maximum size Gravel.
2. Extend from Footing Bottom to underside of Finish Grade surfacing.

**E. Fills at Planting Areas:**

1. Fill with stockpiled Native Topsoil or Imported Loam.

**3.10 COMPACTING FILLS****A. Maintain optimum Moisture Content for compaction.****B. Minimum ASTM D-1557 (modified proctor) Compaction:**

1. Under and within 2 ft. of Slabs and Pavements: 95%
2. Under and within 2 ft. of Foundations: 95%
3. Elsewhere: 90%

**C. Extend Fill-compaction to at least 5 ft. beyond edges of Work to be supported.**



**EARTHWORK****PART 3 - EXECUTION****3.11 WET WEATHER WORK**

- A. If Fill is to be placed during wet weather or under wet conditions when control of Soil Moisture-content is not possible, Fill Material shall contain no more than 5% Material passing No. 200 Mesh Sieve (by weight).
- B. Additionally:
  - 1. Slope Ground Surface in Construction Area and seal with Smooth Drum Roller to promote rapid Water-runoff and to prevent Water-ponding, and
  - 2. Perform Work in small areas, and carry through to completion to minimize exposure to wet weather, and
  - 3. Where Traffic over exposed Subgrade is anticipated, protect Subgrade with 12 inch minimum thickness Working Blanket of compacted clean Crushed Rock applied over non-woven Filter Fabric. Areas used as Haul Routes for heavy Construction Equipment may require thicker Blanket. If necessary limit traffic as required to prevent Soil disturbance, and
  - 4. To prevent Water-absorption, leave no Soil uncompacted. Remove Soil which has become too wet for compaction, and replace with new Specified Fill Material.
- C. Optional Treatment:
  - 1. Immediately following excavation, cover Subgrade with Geotextile Fabric. Overlap Fabric Seams 24 inches minimum.

**3.12 GRADING**

- A. Rough Grading:
  - 1. Grade entire area of Property to reasonably true and even surfaces.
  - 2. Unless otherwise shown on Drawings, slope Ground at 5% rate for at least 10 ft. away from Building to facilitate drainage.
  - 3. Prevent Water-ponding.
  - 4. Grade to uniform levels or slopes between given Grade Points.
  - 5. Round Surfaces at abrupt Grade changes.
- B. Levels:
  - 1. Grade area around Building to the following levels:
    - a. Paving, Walks, and other Hard-surfaced Areas:
      - 1. To underside of Surfacing, allowing for Gravel Base Course.
    - b. Planting Areas:
      - 1. To Finish Grades, allowing for 12 inches of Imported Loam.
- C. Finish Grading:
  - 1. If Subsoil has not been freshly graded, scarify at least 6 inches deep.
  - 2. Spread necessary Imported Loam over Planting Areas to compacted levels shown on Drawings.
  - 3. Without over-compacting, roll and tamp Soil to prevent future settlement.
  - 4. Remove Stones and Clods larger than 3/4 inch in size; Twigs and Sticks; and any other Foreign Matter.
  - 5. Leave Surfaces ready for Soil-preparation Work by Landscape Subcontractor.

**PART 3 - EXECUTION**

**3.13 GRADING TOLERANCE**

- A. Position Finish Grade within 0.10 ft. of Grades shown on Drawings.

**3.14 RECONDITIONING FINISHED WORK**

- A. Where completed Work has been disturbed by subsequent Work, Operations, or Adverse Weather; scarify Surface, re-shape, and re-compact to required Density at no additional cost to Owner.

**3.15 CLEANING & REPAIRING**

- A. Including Work of other Trades, clean, repair and touch-up, or replace when directed, Work which have been soiled, discolored, or damaged by Work of this Section.
- B. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 WORK INCLUDED**

- A. Trenching, Pipe Bedding, and Backfilling for Project Utilities including the following:
1. Water Supply System Piping
  2. Irrigation System Piping
  3. Sanitary Sewer System Piping
  4. Storm Sewer System Piping
  5. Foundation Drainage System Piping
  6. Gas System Piping
  7. Electrical System Wiring
  8. Any other Utility System Work shown on Drawings

**1.3 RELATED INFORMATION SPECIFIED IN OTHER SECTIONS**

- A. Geotechnical Data: Section 02-10-00

**1.4 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. General Earthwork: Section 02-30-00

**1.5 WORK INCLUDED, BUT REIMBURSED BY OWNER**

- A. Should Rock as defined below be encountered, other than any shown in Geotechnical Report, or any shown on Drawings, or any exposed to view during Bidding Period, Owner will pay extra for any necessary Rock removal and take credit for omitted Earth excavation, in accordance with Contract Conditions.
- B. Should Unstable Soil as defined below or excessive Water be encountered, other than any shown in Geotechnical Report, or any shown on Drawings, or any exposed to view during Bidding Period, Owner will pay extra for necessary site dewatering or soil removal, in accordance with Contract Conditions. Owner will not pay for removal or dewatering of Unstable Soil caused by reasonably anticipated inclement weather or by Contractor's work at the Site.
- C. Should Wells, Cisterns, Tanks, Cesspools, Garbage Pits, Foundations, Rubble, etc. be encountered, other than any shown on Geotechnical Report, or any shown on Drawings, or any exposed to view during Bidding Period, Owner will pay extra for any necessary removal and take credit for omitted Earth excavation, in accordance with Contract Conditions.

**PART 1 - GENERAL**

**1.6 DEFINITIONS**

- A. Rock:
  - 1. Material that cannot be removed with Pick and Shovel or by Backhoe with 9500 lb. digging force.
- B. Unstable Soil:
  - 1. Soft, loose, or wet ground that is incapable of supporting Materials, Equipment, Personnel, or Structure.
- C. AASHTO:
  - 1. American Association of State Highway and Transportation Officials, 341 National Press Building, Washington D.C., 20004.
- D. Pipe:
  - 1. Water Supply Pipe, Sewage Pipe, Drainage Pipe, Irrigation Pipe, Gas Pipe, and Electrical Conduit.

**1.7 OPTIONS**

- A. In lieu of providing Crushed Rock, Contractor may at Contractor's option, substitute the following:
  - 1. Pea Gravel or Sand:
    - a. Where subsequent Backfill settlement is considered critical, such as at Trenches below Pavement, Walkways, Curbs, etc.
  - 2. Native Material:
    - a. Where subsequent Backfill settlement is not considered critical, such as at Trenches below Unsurfaced Areas.
- B. In Trenches within Public Right-of-way or Public Easements, substitute Controlled Density Fill (CDF) consisting of 1000 psi minimum density Cement/Gravel mix or 1 inch Crushed Aggregate Base..

**1.8 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.9 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

(Cont.)

**PART 1 - GENERAL**

**1.10 REGULATORY AGENCY REQUIREMENTS**

- A. Obtain and pay for any Permits and Inspections required by governing Agencies and Utility Companies.

**1.11 ADVANCE NOTICES**

- A. Notify Architect and Governing Authorities at least 24 hours prior to covering over Work of this Section so that Inspections can be made.

**1.12 FIELD MEASUREMENTS**

- A. System layout on Drawings, including existing Utility locations, is diagrammatic and may not be exact.
- B. Verify prior to starting Work.
- C. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to starting Work.

**PART 2 - PRODUCTS**

**2.1 CRUSHED ROCK**

- A. Washed, sound, durable, uniform, evenly-graded Rock which is free of soft, friable, thin, elongated, or laminated pieces, disintegrated Material, Organic Matter, Oil, Alkali, or other Deleterious Substance.
- B. Mechanically crush as follows:
  - 1. Fracture at least 70 percent of Particles on at least 2 faces.
  - 2. Unfractured Particles:
    - a. 3/8 inch and larger: 10% maximum
    - b. Smaller than 3/8 inch: 5% maximum
- C. Gradation:
  - 1. Even from Coarse to Fine.
- D. Maximum Size:
  - 1. At Pipe Beds and Pipe Zones: 3/4 inch
  - 2. At Backfills: 1-1/2 inches

**PART 2 - PRODUCTS**

**2.2 PEA GRAVEL**

- A. Round, water-worn, washed, sound, durable, uniform, evenly graded Rock which is free of soft, friable, thin, elongated or laminated Pieces, disintegrated Material, Organic Matter, Oil, Alkali, or other Deleterious Substance.
- B. Maximum Size: 1/2 inch

**2.3 SAND**

- A. Fine granular material naturally produced by Rock disintegration and free from Organic Material, Mica, Loam, Clay, and other Deleterious Substances.

**2.4 NATIVE MATERIAL**

- A. Excavated Soil native to Project Site and free of Solids larger than 3 inch diameter, Wood, and other Deleterious Materials.

**2.5 BURIED UTILITY MARKERS**

- A. Tracer Wire: 18 ga. min. solid Copper protected by Green Insulation.
- B. Metallic Foil:
  - 1. Manufacturer & Brand: Reef Industries, Inc. Terra Tape, or approved.
  - 2. Material: Metallic Foil inert to Soil Conditions
  - 3. Thickness: 1 mil
  - 4. Width: 3 inches
  - 5. Imprinted Message:
    - a. "Caution (Type of Utility) Line buried below"
    - b. Repeat Message over full length of Tape
- C. Access Boxes: Provide Valve Boxes, Cleanouts, etc. for Marker toning
- D. Extent of Work: Provide both Markers directly above all metallic and non-metallic Buried Utility Pipe.

**2.6 CASINGS FOR BORED CROSSINGS, IF ANY**

- A. Material: Schedule 40 Plastic Pipe
- B. Diameter: As required to provide adequate working space for Pipe installation.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Prior to starting Work, verify that existing conditions are suitable to perform work.
- B. Notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.
- D. Should any suspected Contaminated Soil be encountered perform the following:
  - 1. Immediately notify Architect and Dept. of Environmental Quality.
  - 2. Comply with Architect's directions and Regulatory Agency requirements.
  - 3. Perform no Work that could disturb or spread suspected Contaminated Soil.
  - 4. Owner will employ and pay Testing Lab to confirm presence of Contaminated Soil.
  - 5. If Laboratory Tests confirm presence of Contaminated Soil, Owner will remove Contaminated Soil and will issue Change Order increasing Contract Sum for any proven additional cost to the Contractor and extending Contract Completion Date for any proven Contractor's lost time.

**3.2 SOIL BEARING TESTS**

- A. Should Contractor doubt Bearing Capacity of Existing Soil, Tests at Owner's expense may be ordered by Architect.

**3.3 TRAFFIC CONTROL**

- A. Provide Barricades, Detours, Warning Devices, Flaggers, and Equipment Movement necessary to maintain Vehicle and Pedestrian Traffic on public or private Streets and Walks.

**3.4 PROTECTING OTHER WORK**

- A. Existing Monuments:
  - 1. Carefully maintain Bench Marks, Monuments, and other Reference Points.
  - 2. If disturbed or destroyed, replace as directed.
- B. Existing Utilities:
  - 1. Existing Utilities shown on Drawings are located according to best available information, but accuracy is not guaranteed.
  - 2. Protect encountered active Utilities against damage or dislocation.
  - 3. As directed by Utility Owner, repair or replace active Utilities damaged by work of this Section.
  - 4. Remove inactive or abandoned Utilities from within Building Lines. Plug or cap at least 3 feet outside Building Lines.

(Cont.)

**PART 3 - EXECUTION**

**3.4 PROTECTING OTHER WORK (Cont.)**

- C. Erosion, Silt, & Sediment Control:
  - 1. In compliance with requirements of Dept. of Environmental Control (DEQ) and other Governing Agencies, prevent Eroded Material, Silt, and Sediment against entering into any Watercourse or Storm Drain, and onto any adjacent Property.
- D. Street Cleaning:
  - 1. Maintain Public and Private Streets and Walkways clean at all times.
- E. Dust Control:
  - 1. Protect Persons and Property against damage and discomfort caused by Dust. Spry-apply Water where necessary and when directed.
- F. Existing Trees to remain.
  - 1. Protect against damage as specified in Section 01-56-00.
- G. Open Trenches:
  - 1. Protect Persons and Property against injury and damage caused by Open Trenches.
- H. Other Work & Adjacent Property:
  - 1. Protect against damage and discoloration caused by work of this Section.

**3.5 CUTTING EXISTING PAVEMENT, IF ANY**

- A. Cut prior to excavation with vertical, straight-line Joints using Pavement Saw.
- B. Except where Utility Piping requires otherwise, make Cuts parallel or perpendicular to Pavement centerline.
- C. Cut Width: Except where Utility Piping requires otherwise, extend Cut 1 ft. beyond each side of Trench.
- D. Replace Pavement to condition at least as good as existing prior to cutting. Comply with Project Specifications.

**3.6 TRENCHING**

- A. Before Starting to Excavate:
  - 1. Strip available Topsoil from areas to be excavated.
  - 2. Stockpile Topsoil where and as directed by General Contractor.
- B. Excavating:
  - 1. Excavate to Lines and Grades shown on Drawings or Specifications, unless otherwise directed by Architect.
  - 2. Allow ample Space for Pipe and Pipe Bedding.
  - 3. Leave Bearing Surfaces undisturbed, level, and true.
  - 4. Hand-grade where necessary.
- C. Blasting:
  - 1. None permitted.

(Cont.)



**PART 3 - EXECUTION**

**3.6 TRENCHING (Cont.)**

- D. Depth:
1. Unless otherwise specified or shown on Drawings, allow for at least 24 inches cover over Pipe.
- E. Excavation Width:
1. Where parallel Pipes are to be laid within single Trench:
    - a. At least 18 inches wider than sum of inside diameters of parallel Pipes plus distance between Pipes.
  2. Elsewhere:
    - a. For 4 inch I.D. Pipes & Smaller, if any:
      1. Irrigation Pipe: 9 inches minimum
      2. Elsewhere: 18 inches minimum
    - b. For 6 inch I.D. & larger Pipes, if any: 24 inches minimum
  3. Increase widths where directed by Architect and where necessary to receive Shoring.
  4. Do not damage adjacent Structures or Property.
  5. Do not extend Excavation beyond Construction Easements, unless approved by affected Property Owners.
- F. Temporary Stockpiling of Excavated Material:
1. Locate within Construction Area.
  2. Unless otherwise approved, do not obstruct Private or Public Streets, Drives, or Walkways.
  3. Locate at least 2 ft. from Trench edges. Contractor responsible for safe-loading Trenches.
  4. At Temporary Stockpiles remaining during Rainy Periods, grade and cover Stockpile as required to prevent Compaction, Erosion, and Water Infiltration.
- G. Over-excavation:
1. Where Excavation, through Contractor's error, is carried to levels lower than those shown on Drawings, fill with compacted Pipe Bedding Material to proper levels at no additional cost to Owner.
- H. Shoring:
1. Brace, shore sides, or increase width of excavations as necessary to prevent Cave-ins.
  2. Repair Slides and Cave-ins should they occur.
  3. Remove Shoring before Backfilling.
- I. Water & Frost:
1. Keep Bearing Surfaces dry and frost-free.
  2. When working within Excavation, provide and operate Pumping Equipment necessary to keep excavations free from Standing Water. Do not reduce adjacent Ground Water level to extent that could endanger or damage adjacent Structures or Property. When releasing Ground Water to its static level, prevent Pipe floatation and Backfill disturbance.
  3. Should Bearing Surfaces be softened by Water or Frost, re-excavate to solid bearing and fill at Contractor's expense as specified above for Over-excavation.

**PART 3 - EXECUTION**

**3.7 EXCESS & UNSUITABLE EXCAVATED MATERIAL**

- A. Remove from Site, and lawfully dispose.

**3.8 PIPE BEDDING INSTALLATION**

- A. Material:
  - 1. At any Plastic Pipe or direct-buried Electrical Wiring: Sand
  - 2. At Other Pipe: Crushed Rock
- B. Fill full Trench width.
- C. Minimum thickness below Pipe bottom: 4 inches
- D. Excavate Bell Holes at each Joint to permit proper Joint assembly and inspection.
- E. Hand-shape Trench Bottom to provide uniform, even-support over bottom 120° of Pipe.
- F. Firmly support full Pipe length; do not rest Bell-to-Bell.

**3.9 PIPE ZONE MATERIAL INSTALLATION**

- A. Material:
  - 1. Within 12 inches of Plastic Pipe: Sand
  - 2. Elsewhere: Crushed Rock
- B. Fill full Trench width.
- C. Sufficiently compact Pipe Zone Material to prevent Pipe movement during final backfilling.
- D. At Pipe smaller than 15 inches diameter: Backfill with Pipe Zone Material to 12 inches above Pipe top.
- E. At 15 inch and larger diameter Pipe: Backfill up to Pipe Spring-line simultaneously on both sides and carefully pack under Pipe Haunches.

**3.10 BURIED UTILITY MARKER INSTALLATION**

- A. Install at the following uniform distance above the top of Buried Pipe:
  - 1. Minimum: 10 inches
  - 2. Maximum: 12 inches

(Cont.)

**PART 3 - EXECUTION**

**3.11 BACKFILLING**

- A. Remove Debris and Decayable Matter from areas to be filled before proceeding.
- B. Make Fills as soon as feasible to assure thorough settlement.
- C. Do not drop sharp, heavy Material onto Pipe.
- D. Do not use sharp Tamping Tool around Pipe.
- E. Do not push Backfill Material into Trench allowing Material to free-fall into open Trench, until at least 2 feet of Cover is provided over Pipe.
- F. Place Fills in 6 to 8 inch maximum Lifts.

**3.12 BACKFILL COMPACTION**

- A. Compact with Mechanical Vibration.
- B. Maintain optimum Moisture Content for compaction.
- C. Minimum ASTM D-1557 (modified proctor) Compaction:
  - 1. Under and within 2 ft. horizontally and vertically of Structure Foundations, Slabs, or Pavements: 95%
  - 2. Elsewhere: 90%
- D. Do not compact by Water-setting or Water-jetting methods.
- E. Refer to Section 01-45-30 for Testing details.
- F. Replace any Slabs and Pavement which develop Settlement Cracks during Warranty Period.
- G. Re-grade any Unsurfaced Areas where settlement develops during Warranty Period.

**3.13 TRENCH BACKFILL MAINTENANCE**

- A. Continually maintain unsurfaced Backfilled Trenches throughout Construction Period.

**3.14 PROTECTING COMPLETED WORK**

- A. Protect against displacement and intrusion by foreign Matter.

**3.15 PRODUCT CLEANING & REPAIRING**

- A. Where completed areas are disturbed by subsequent Construction Operations or Adverse Weather, scarify Surface, re-shape, and compact to required Density prior to further Construction.
- B. 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.
- C. Remove Debris from Project Site upon work completion, or sooner if directed.

**END OF SECTION**

**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 WORK INCLUDED BUT SPECIFIED IN OTHER SECTION**

- A. Trenching & Backfilling for Work of this Section: Section 02-31-50

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Underground Storm Drainage System & connections to this Work: See Civil Specifications

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.6 RECORD DRAWINGS**

- A. Submit in accordance with requirements specified in Section 01-82-00.

**1.7 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage.
- B. Store Plastic Pipe on firm, level support; protect against direct Sunlight.
- C. Store Plastic Pipe Cement in cool location.

**1.8 TEMPERATURE**

- A. 32°F minimum and 110°F maximum at mating surfaces of Plastic Pipe and Fittings.

**PART 1 - GENERAL**

**1.9 FIELD MEASUREMENTS**

- A. System layout on Drawings , including Sewer location and depth, is diagrammatic and may not be exact.
- B. Verify prior to starting Work.
- C. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to starting Work.

**1.10 ADVANCE NOTICES**

- A. Notify Architect at least 24 hours prior to covering over Work of this Section so inspections can be made.

**PART 2 - PRODUCTS**

**2.1 DRAIN PIPE**

- A. Manufacturer: ADS, Hancor, or approved.
- B. Material: Corrugated, perforated Plastic Tubing
- C. Fittings: Match Pipe
- D. Diameter: 4 inches, unless otherwise shown on Drawings.

**2.2 FILTER FABRIC**

- A. Manufacturer & Brand: Carthage Polyfilter X, Celanese Mirafi 140S, Amoco Propex 4545, or approved.
- B. Maximum Mesh Size: U.S. Standard #100 Sieve
- C. Extent of Work: Provide within Gravel Backfill to prevent Sand, Silt, or Fine Aggregates against entering Drain Pipe.

**2.3 PIPE BED & BACKFILL MATERIALS**

- A. Specified in Section 02-31-50.

**2.4 OTHER MATERIALS**

- A. Recommended by Manufacturer and subject to Architect's review and acceptance.
- B. Provide all required to complete and make System operational.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Drainage Subgrade Surfaces prepared by other Trades are accurately located, graded, compacted, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING OTHER WORK**

- A. Monuments:
  - 1. Carefully maintain Bench Marks, Monuments, and other Reference Points.
  - 2. If disturbed or destroyed, replace as directed.
- B. Existing Utilities:
  - 1. Existing Utilities shown on Drawings are located according to best available information, but accuracy is not guaranteed.
  - 2. Protect active Utilities encountered; notify Utility Owner.
  - 3. Repair or replace Utility Lines damaged by work of this Section.
  - 4. Remove inactive or abandoned Utilities from within Building Lines. Plug or cap at least 3 ft. outside Building lines.
- C. Street Cleaning: Maintain public and private Streets, Walkways, and Drives 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. Existing Street Trees: Protect against damage. See Section 01-56-00.
- F. Work of Other Sections: Protect against damage and discoloration caused by Work of this Section.

**3.3 TRENCHING & PIPE BEDDING**

- A. Specified in Section 02-31-50.

**3.4 DRAIN PIPE INSTALLATION**

- A. Set Foundation Drain inverts no lower than 4 inches below adjacent Footing top.
- B. Install Pipe with Perforations facing downward.
- C. Slope Pipe toward and connect to Storm Drainage System.

**3.5 ALLOWABLE INSTALLATION TOLERANCES**

- A. Install Piping within 1/4 inch of indicated Grade, Location, and Pitch.

**PART 3 - EXECUTION**

**3.6 FILTER FABRIC INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Minimum Joint Lap: 18 inches

**3.7 PROTECTING INSTALLED WORK**

- A. Protect Drain Pipe against displacement and intrusion by Foreign Matter.
- B. Prevent prolonged exposure of Filter Fabric to Sunlight.
- C. Prevent Traffic on unprotected Filter Fabric.

**3.8 BACKFILLING**

- A. Specified in Section 02-31-50.

**3.9 WASTE MANAGEMENT**

- A. Collect Cut-offs, Scrap, Shipping Pallets, Metal Strapping, & Packaging Waste; and place where directed for recycling.

**3.10 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**CAST-IN-PLACE CONCRETE DRIVES, WALKS, CURBS, & GUTTERS****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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Rough Grading & Fill Under Work of this Section: Section 02-30-00
- B. Exterior Concrete Flatwork other than Walkways: Section 03-30-00

**1.3 DESIGN & ENGINEERING**

- A. Formwork Design and Engineering, as well as Construction, are Contractor's responsibility.

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 REFERENCED SPECIFICATIONS**

- A. If and where working within Public Right-of-way, comply with governing Public Agency Specifications, if more restrictive than specified herein.

**1.6 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.7 FIELD MOCK UPS**

- A. Before starting Work and in accordance with Section 01-33-00, prepare 20 sq. ft. (min.) Mock Up of Exposed Aggregate Concrete Walkway Surface Texture.
- B. Re-prepare, if directed, until accepted.
- C. Accepted Mock Up represents minimum quality standard. Work of lesser quality will be subject to rejection and replacement. Accepted Mock Up, in like new condition, may be used in Contract Work.



**CAST-IN-PLACE CONCRETE DRIVES, WALKS, CURBS, & GUTTERS****PART 1 - GENERAL****1.8 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.
- B. Conform to ASTM C-94.

**1.9 WEATHER REQUIREMENTS**

- A. Cold Weather:
  - 1. Follow Standard Specification for Cold Weather Concreting, ACI 306.1, copies of which can be obtained from the Institute at 38800 Country Club Dr.; Farmington Hills, MI 48331.
  - 2. Do not place Concrete during cold weather (40°F or less) until Protection Materials and Equipment are at or near Project Site.
  - 3. Place no Concrete on frozen Subgrade.
  - 4. Remove Ice and Snow from Reinforcing, Forms, Embedded Items, and other Contract Surfaces.
  - 5. Raise and maintain temperature of all Surfaces in contact with Concrete above 40°F prior to Concrete placement.
  - 6. Do not use Salts or Chemical Admixtures to prevent Concrete freezing.
  - 7. Terminate any Water Curing at least 24 hours before any anticipated freezing temperatures.
  - 8. Following protection period, allow Concrete to cool gradually.
  - 9. Assume responsibility, including costs, for testing suspected frozen Concrete.
  - 10. Remove and replace freeze-damaged Concrete at Contractor's expense.
- B. Warm Weather:
  - 1. When Air temperature exceeds 85°F or when Wind exceeds 10 mph, place Concrete in accordance with the following requirements:
    - a. Maximum Concrete temperature at time of placement: 70°F.
    - b. Mix Concrete minimum possible time, and place as soon as possible thereafter.
    - c. Sprinkle Forms, Reinforcing, Embedded Items, and Subgrade with cool Water immediately prior to Concrete placement.
    - d. Protect unstripped Formwork and exposed Concrete surfaces against excessive drying with water spray or other approved method.
  - 2. Assume responsibility, including costs, for testing Damage-suspected Concrete.
  - 3. Remove and replace heat-damaged or wind-damaged Concrete at Contractor's expense.

**1.10 MINIMUM ILLUMINATION**

- A. Perform no work under less than 30 ft. candle Illumination measured 3 ft. above Ground.

**CAST-IN-PLACE CONCRETE DRIVES, WALKS, CURBS, & GUTTERS****PART 2 - PRODUCTS****2.1 FORMS**

- A. Material: Smooth, warp-free Steel, straight Wood Plank, or approved.
- B. Minimum Strength: Without Concrete deformation, support Concrete and withstand impact induced by Concrete placement and vibration.
- C. Fabrication:
  - 1. Provide Holes for required Reinforcement Assemblies.
  - 2. Provide each Form Section with positive Locking Device to align and secure Formwork in accurate position.

**2.2 FORM TREATMENT MATERIALS**

- A. Manufacturer & Brand: Contractor's choice.
- B. Type: Biodegradable and non-staining
- C. VOC Content: 0

**2.3 REINFORCEMENT BARS**

- A. Material: 100% recycled Steel
- B. Manufacturing Standard: ASTM A-615
- C. Grade: 60, unless otherwise shown on Drawings.
- D. Extent of Work: Unless otherwise shown on Drawings, provide the following:
  - 1. One #4 Bar continuously in both top and bottom of each Cast-in-place Concrete Curb.
  - 2. One #4 Bar continuously in top, bottom, and toe of each Concrete Gutter.
  - 3. One #4 Bar across full-width of any Stair Nosings.

**2.4 REINFORCEMENT MESH**

- A. Material: Steel Wire Mesh
- B. Manufacturing Standard: ASTM A-185
- C. Wire Size: W2.9
- D. Mesh Opening Size, unless otherwise shown on Drawings:
  - 1. In Walkways: 6x6 inches
  - 2. In Flatwork where subject to Vehicular Loads: 2x2 inches
- E. Extent of Work: Provide in all Flatwork.

(Cont.)

**CAST-IN-PLACE CONCRETE DRIVES, WALKS, CURBS, & GUTTERS****PART 2 - PRODUCTS****2.5 REINFORCEMENT ACCESSORIES**

- A. Material: Concrete, Ceramic, Plastic, or Steel. Hot-dip galvanize any Steel Accessories located within 1/2 inch of Concrete surfaces.
- B. Manufacturing Standard: Manual of Standard Practice, published by Concrete Reinforcing Steel Institute; 180 N. LaSalle Street; Chicago, IL 60601. Copies can be obtained from Institute.
- C. Extent of Work: Provide all Accessories necessary for proper Reinforcement placement, spacing, support, and fastening.

**2.6 REINFORCEMENT FABRICATION**

- A. Follow Manual of Standard Practice published by Concrete Reinforcing Steel Institute.
- B. Allowable Bar Reinforcement Fabrication Variation from Drawing Dimensions:
  - 1. Sheared Length: Plus or minus 1 inch.
  - 2. Tie Dimensions: Plus or minus 1/2 inch.
  - 3. All other Bend Dimensions: Plus or minus 1 inch.

**2.7 PORTLAND CEMENT**

- A. Manufacturing Standard: ASTM C-150
- B. Type: I-II

**2.8 AGGREGATE**

- A. Manufacturing Standard: ASTM C-33
- B. Maximum Size: 3/4 inch at Exposed Aggregate Flatwork, 1-1/2 inches elsewhere, and not more than one-fifth of narrowest dimension between sides of Forms, one-third of depth of Flatwork, or three-fourths of narrowest space between Reinforcing Bars.
- C. Source: Aggregates for exposed Concrete shall be of matching size and shall come from same source.

**2.9 ENTRAINED AIR**

- A. Manufacturing Standard: ASTM C-260
- B. Air Amount: 5% to 7% of Concrete Volume.
- C. Extent of Work: Provide in all Concrete.

**CAST-IN-PLACE CONCRETE DRIVES, WALKS, CURBS, & GUTTERS****PART 2 - PRODUCTS****2.10 FLY ASH**

- A. Manufacturing Standard: ASTM C-618
- B. Class: F
- C. Maximum Fly Ash content: 20% of Cement weight
- D. Extent of Work: May be used at Contractor's option.

**2.11 WATER REDUCING ADMIXTURES**

- A. Manufacturing Standard: ASTM C-494
- B. Type: A
- C. Extent of Work: May be used at Contractor's option.

**2.12 CALCIUM CHLORIDE**

- A. None permitted.

**2.13 DETECTABLE STRIPS FOR WARNING DISABLED PERSONS**

- A. Manufacturer: Vanguard (800) 290-5700, Wausau Tile (800) 388-8728, or approved.
- B. Style: Truncated Dome
- C. Color: Yellow
- D. Extent of Work & Manufacturing Standard:
  - 1. Comply with U.S. Americans with Disabilities Act (ADA), and other applicable Codes, Regulations, and Ordinances.
  - 2. Provide over full-width of Curb Ramps and extend 24 inches minimum in direction of Pedestrian travel.

**2.14 EXPANSION JOINT FILLER**

- A. Material: Asphalt-impregnated Cane Fiber
- B. Manufacturing Standard: ASTM D-1751
- C. Thickness: 3/8 inch
- D. Depth: As required to extend through full Slab depth and to position Filler top 1/4 inch below adjacent Slab top.

(Cont.)

**PART 2 - PRODUCTS**

**2.15 CURING COMPOUND**

- A. Type: Non-yellowing and with disappearing White Pigment.
- B. Manufacturer & Brand: Contractor's choice
- C. Manufacturing Standard: ASTM C-1315, Type II, Class A.

**2.16 OTHER CONCRETE INGREDIENTS**

- A. See Section 03-30-00.

**2.17 CONCRETE MIXING**

- A. General:
  - 1. Readymix type conforming to ASTM C-94
  - 2. Assume responsibility for Mix design and Product performance.
- B. Design Strength:
  - 1. Minimum 28 day compressive strength: 3500 psi
- C. Maximum Slump:
  - 1. 4 inch Slump at any time is maximum. Add Water only with Architect's permission.
  - 2. Concrete with greater Slump will be rejected and must be replaced.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Prior to Formwork Installation:
  - 1. Verify that Earthwork is complete and Granular Base is compacted as specified.
- B. Prior to Reinforcement Installation:
  - 1. Verify that Surfaces and Formwork to receive Reinforcement are accurately sized and located, square, plumb, rigid, secure, and otherwise properly prepared.
- C. Prior to Concrete Placement:
  - 1. Verify that Formwork, Reinforcement, and Embedded Items are accurately and securely placed, clean, water and frost-free, and ready to receive Concrete.
  - 2. Prior to starting Work, notify General Contractor about defects requiring correction.
  - 3. Do not start Work until conditions are satisfactory.

**CAST-IN-PLACE CONCRETE DRIVES, WALKS, CURBS, & GUTTERS****PART 3 - EXECUTION****3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 FORMWORK INSTALLATION**

- A. Conform to shapes, lines, and dimensions shown on Drawings.
- B. At Flatwork, position Formwork to produce 1/4 inch per foot minimum drainage-slope.
- C. Brace and tie together to insure that position and shape are maintained.
- D. Make tight to prevent Concrete leakage.

**3.4 FORMWORK BRACING**

- A. Provide as required to meet Load Requirements.
- B. Protect against undermining or settlement when placed on ground.
- C. Anchor as required to prevent upward or lateral Formwork movement during Concrete placement.

**3.5 TREATMENT OF FORMS**

- A. Lightly oil immediately prior to Concrete Placement.

**3.6 FORMWORK ADJUSTMENTS**

- A. Reposition to true alignment prior to, during, and after Concrete placement, if necessary.
- B. During Concrete placement, in areas where Formwork develops weakness, settlement, or distortion, stop Concrete placement, remove placed Concrete, and remove or strengthen Formwork.

**3.7 FORMWORK CLEANING**

- A. Remove debris and foreign matter from Formwork prior to Concrete placement.
- B. Remove loose rust and foreign matter from reusable Hardware prior to installation into Formwork.

**3.8 FORMWORK REMOVAL**

- A. Leave Forms in place until Concrete has attained sufficient strength to safely support own weight and any imposed loads.

**CAST-IN-PLACE CONCRETE DRIVES, WALKS, CURBS, & GUTTERS****PART 3 - EXECUTION****3.9 FORMWORK RE-USE**

- A. Withdraw projecting Fasteners and clean Concrete Form contact surfaces. Replace with new material when necessary or when directed.
- B. Re-use Forms only when contact-surfaces equal those specified for original use.

**3.10 REINFORCEMENT INSTALLATION**

- A. Comply with requirements specified in Section 03-20-00.

**3.11 GRANULAR BASE PREPARATION**

- A. Remove foreign matter from surfaces and areas to receive Concrete.
- B. Dampen Granular Base and any other Porous Surfaces to eliminate suction.

**3.12 CONCRETE BOND**

- A. Coat Bonding Agent over existing Concrete to be joined with new Concrete.
- B. Follow Manufacturer's directions.

**3.13 CONCRETE PLACING**

- A. Convey and place by methods which will prevent Material separation and loss.
- B. Do not retemper or use set Concrete.
- C. Do not place Concrete around Catch Basins, Valve Boxes, etc. until such Items are set at correct elevation and approved.

**3.14 CONCRETE COMPACTION**

- A. Employ mechanical, high-frequency Vibrators to consolidate Concrete around Reinforcement, into corners and angles of Forms, and to exclude rock pockets, air bubbles, and honeycomb.
- B. Hold Vibrator in one spot no longer than 15 seconds; keep in constant motion, insert and withdraw at points approximately 18 inches o.c.
- C. Maintain Vibrator in vertical position when penetrating Concrete.
- D. Do not transport Concrete with Vibrator.
- E. Consolidate Concrete without Aggregate segregation.

**PART 3 - EXECUTION**

**3.15 WALKWAY JOINTS**

- A. General:
  - 1. Make perpendicular to line of Walkway.
  - 2. Form to true, straight lines, with Slabs flush at joints.
  - 3. Joint-shape: 1/4 inch maximum radius
- B. Construction Joints:
  - 1. Maximum Spacing: 25 ft. o.c.
  - 2. Provide Expansion Joint Fillers in Joints.
- C. Weakened-plane Shrinkage-control Joints:
  - 1. Over Walk Length: Equally space Joints between 4 ft. min. and 5 ft. max. apart.
  - 2. Over Walk Width:
    - a. At Walks up to 5 ft. wide: No Joints required
    - b. At Walks between 5 ft & 10 ft. wide, if any: Provide Longitudinal Joint centered in Walk width.
    - c. At Walks wider than 10 ft., if any: Layout Joints in pattern approved by Architect.
  - 3. Joint Depth: 1/3 of Slab thickness
  - 4. Joint Width: 1/8 inch

**3.16 CURB & GUTTER JOINTS**

- A. General:
  - 1. Make perpendicular to line of adjacent Curb and Gutter.
- B. Weakened-plane Shrinkage-control Joints:
  - 1. Insert into Curbs and Gutters 1/8 inch thick, removable, Steel Plate matching Curb and Gutter profile as follows:
    - a. Align with any adjacent Walkway Control Joints.
    - b. Maximum Spacing: 15 ft. apart
  - 2. As soon as possible without Concrete damage, remove Steel Plate, and tool exposed Curb and Gutter edges to 1/8 inch radius.
- C. Expansion Joints:
  - 1. Locate as follows:
    - a. Align with adjacent Walkway Expansion Joints.
    - b. Maximum Spacing: 45 ft. apart
    - c. Provide Expansion Joint Fillers in Joints.
  - 2. Extend Reinforcing Dowels through Joints.

**3.17 DETECTABLE STRIPS FOR WARNING DISABLED PERSONS**

- A. Follow Manufacturer's instructions.
- B. Set flush with adjacent Pavement Surfaces.



**CAST-IN-PLACE CONCRETE DRIVES, WALKS, CURBS, & GUTTERS****PART 3 - EXECUTION****3.18 CONCRETE FINISHING**

- A. Exposed Aggregate Finish:
  - 1. Evenly distribute and darby-in 3/8 inch round, washed River Rock.
  - 2. After initial Concrete set, carefully remove Cement Matrix by washing and brushing to expose Aggregate approximately 1/16 inch deep.
  - 3. After final curing, clean Surfaces with 10% Muriatic Acid Solution, or approved, and rinse Slab with clean Water.
  - 4. Apply Transparent Water Repellent specified in Section 07-18-00.
  - 5. Extent of Work: Provide where shown on Drawings.
- B. Elsewhere:
  - 1. Draw damp Fine Hair Broom across Concrete surface as follows:
    - a. At Walkways: Perpendicular to Traffic direction
    - b. At Curbs & Gutters: Parallel with Curb and Gutter direction

**3.19 WALKWAY 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.
- B. Take particular care to maintain surface on both sides of Joint in same plane.
- C. Do not use Kneeling Planks on Concrete surface.

**3.20 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. If Concrete may be exposed to Deicing Chemicals within 30 calendar days following Curing Period completion: Cure with Water (*not Curing Compound*)

**3.21 DEFECTIVE WORK**

- A. Remove and replace any Surfaces which show excessive cracks, Slabs which do not drain properly, and other defective Concrete.
- B. Maximum Surface Unevenness: 1/4 inch per 10 ft.
- C. Compressive Strength Tests: Refer to Section 01-45-30.

**CAST-IN-PLACE CONCRETE DRIVES, WALKS, CURBS, & GUTTERS****PART 3 - EXECUTION****3.22 PROTECTING COMPLETED WORK**

- A. Protect Work specified herein against damage and discoloration.
- B. Replace, at no additional cost to Owner, any damaged or discolored Work.

**3.23 WASTE MANAGEMENT**

- A. Collect Cut-offs, Scrap, Shipping Pallets, Metal Strapping, & Packaging Waste; and place where directed for recycling.

**3.24 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 WORK INCLUDED**

- A. Provide Fencing where located on Drawings.

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 REFERENCED SPECIFICATIONS**

- A. Comply with applicable requirements of specifications published by Chain Link Fence Manufacturer's Institute; 9891 Broken Land Parkway; Suite 300; Columbia, MD 21046; (301) 596-2583.
- B. Specifications can be obtained from Institute.

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.6 INSTALLER'S QUALIFICATIONS**

- A. Employed by, or acceptable to, Fence Manufacturer

**1.7 REGULATORY AGENCY REQUIREMENTS**

- A. Gate Latches shall conform to applicable requirements of Americans with Disabilities Act (ADA).

**1.8 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.
- B. Deliver with Manufacturer's Tags and Labels intact and legible.
- C. Labels or Tags shall identify Manufacturer, brand name, material, size, and applicable standards.

**PART 1 - GENERAL**

**1.9 GROUND & AIR TEMPERATURE**

- A. Above 32°F during Concrete Footing placement, and for 72 hours minimum thereafter.
- B. Remove and replace freeze-damaged Concrete.

**PART 2 - PRODUCTS**

**2.1 POSTS & FRAMES**

- A. Material: Zinc-coated Steel
- B. Coating:
  - 1. Material: 7 mil thick PVC thermally-fused to Posts and Frames
  - 2. Color: Selected by Architect after Contract award from Manufacturer's standard choices.
  - 3. Shape: Round
- C. Outside Diameter:
  - 1. Line Posts: 2-3/8 inches
  - 2. Top & Brace Rails: 1.66 inches
  - 3. Terminal Posts: 2 -7/8 inches
- D. Fence Height: 144 inches
- E. Required Brace Locations:
  - 1. Between Post tops
  - 2. Gate Posts
  - 3. End Posts
  - 4. Pull Posts
  - 5. Corner Posts, including adjustable, diagonal, 3/8 inch diameter Tension Rods.

**2.2 GATES**

- A. Material: Match Posts and Frames.
- B. Type: Double Leaf Swinging
- C. Gate Frame Section Shape: Round
- D. Corner Fittings: Manufacturer's standard for conditions of use
- E. Bracing: Adjustable, 3/8 inch diameter, diagonal Tension Rod
- F. Hinges:
  - 1. Type: Non-lift-off
  - 2. Quantity: 1-1/2 pr. per Leaf

(Cont.)

**PART 2 - PRODUCTS**

**2.2 GATES (Cont.)**

- G. Required Accessories:
  - 1. Latching Devices:
    - a. Type: Plunger
    - b. Accessibility: Operable from either side of Gate
  - 2. Hold-open Keepers on Gates over 5 ft. wide
  - 3. Provisions for Padlocking

**2.3 FABRIC**

- A. Material: 9ga. Steel Wire
- B. Coating:
  - 1. Material: 7 mil thick PVC thermally-fused to Wire
  - 2. Color: Selected by Architect after Contract award from Manufacturer's standard choices.
- C. Mesh Opening Size: 2 inches square
- D. Selvage: Knuckled top and bottom

**2.4 SLATS**

- A. Material: Vinyl Plastic
- B. Color: Selected by Architect after Contract award from Manufacturer's standard choices.
- C. Size: Fit Fabric Mesh openings.
- D. Extent of Work: Provide Slats in all Fencing.

**2.5 BARBED WIRE FENCE & GATE TOPS**

- A. None Required

**2.6 ACCESSORIES**

- A. Follow Referenced Specifications.
- B. Provide all required for complete installation.

(Cont.)

**PART 2 - PRODUCTS**

**2.7 CONCRETE**

- A. Cement: ASTM C-150 type I-II
- B. Aggregate: ASTM C-33, 3/4 inch maximum.
- C. Water: Clean & potable
- D. Entrained Air: ASTM C-160, 3% - 5% of Concrete Volume.
- E. Max. Slump: 3 inches
- F. Min. 28 day Compressive Strength: 2,500 psi

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Site and Ground Work are accurately graded, completed, and in condition to receive Fencing.
- B. Prior to starting Work notify General Contractor of defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING OTHER WORK**

- A. Protect against damage and discoloration caused by Work of this Section.
- B. Protect contacting Dissimilar Materials against Galvanic Corrosion.
- C. Protect existing Vegetation against damage.

**3.3 SITE CLEARING**

- A. Completely clear areas within 1 ft. of Fence Post Footing, and within 6 inches of Fence Fabric.

(Cont.)

**PART 3 - EXECUTION**

**3.4 INSTALLATION**

- A. General:
  - 1. Install rigid, plumb, true, in perfect alignment, and in accordance with Manufacturer's instructions and Referenced Specifications.
- B. Posts:
  - 1. Set plumb to 1/4 inch in 10 ft. and not more than 10 ft. apart.
  - 2. In Ground:
    - a. Set not less than 36 inches deep into 12-inch diameter Concrete Footings; not less than 4 inches of Concrete below Post bottom.
    - b. Remove excavated Earth.
- C. Fabric:
  - 1. Install taut, cover full-height of Fence, and extend to within approximately 1 inch above adjacent Ground Surface at Posts.
  - 2. Join Fabric ends by weaving with single strand of Fabric Wire to form continuous mesh pattern with Selvage twisted to match Fabric.
- D. Gates:
  - 1. Install plumb and level within 1/4 inch in 10 ft.
  - 2. Install Ground-Set Items in Concrete.

**3.5 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Substantial Project Acceptance and during Warranty Period.
- B. Lubricate where necessary.

**3.6 WASTE MANAGEMENT**

- A. Collect Post and Fabric Trimmings, Shipping Pallets, Metal Strapping, & Packaging Waste; and place where directed for recycling.

**3.7 PRODUCT CLEANING & REPAIRING**

- A. 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
- B. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 EXTENT OF WORK**

- A. Drawings and Specifications indicate Contract Work.
- B. If Work adjustments must be made because of hidden unacceptable soil conditions, Contract Sum will be adjusted in accordance with Contract Conditions.

**1.3 PRODUCTS INSTALLED, BUT FURNISHED UNDER OTHER SECTIONS**

- A. Build in as directed by those Trades, without weakening or defacing Formwork.

**1.4 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Formwork for Concrete Walks & Curbs: Section 02-77-00
- B. Concrete Reinforcement including Bar Supports & Accessories: Section 03-20-00
- C. Cast In Place Concrete: Section 03-30-00
- D. Metal Decking to receive Concrete: Section 05-30-00
- E. Hangers & Inserts for Mechanical & Electrical Work: See Mechanical & Electrical Specifications

**1.5 DESIGN & ENGINEERING**

- A. Formwork Design and Engineering, as well as Construction, are Contractor's responsibility.
- B. Minimum Formwork Strength: Withstand pressure exerted by Concrete placement and consolidation.
- C. Maximum Formwork Deflection at any exposed Concrete:  $L/240$  of Formwork Span
- D. Formwork Construction Joint Locations:
  - 1. Where Joints least-impair Formwork strength
  - 2. Within middle  $1/3$  of Concrete span. If any Beam intersects Girder within this area, offset Girder Joint no less than twice Beam width.
  - 3. Wall & Column Joints:
    - a. Locate at underside of any adjacent Floors, Slabs, Beams, and Girders.
    - b. Locate at top of any adjacent Footings and Floor Slabs.
  - 4. Make Joints perpendicular to adjacent primary Steel Reinforcement.



**PART 1 - GENERAL**

**1.6 REFERENCED SPECIFICATIONS**

- A. Unless otherwise specified herein, conform to applicable requirements of Section 2 of ACI 301, Specifications for Concrete Construction, published by American Concrete Institute (ACI); 38800 Country Club Dr.; Farmington Hills, MI 48331; (248) 848-3800.

**1.7 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.8 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.9 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.

**PART 2 - PRODUCTS**

**2.1 WOOD PLANK FORMS**

- A. Material: Lumber
- B. Species: Douglas Fir or Hemlock
- C. Moisture Content: Contractor's choice
- D. Casting Face Texture: Smooth
- E. Casting Face Appearance:
  - 1. No loose Knots or Knot Holes
  - 2. Maximum Knot Size: 1-1/2 inches and well scattered
- F. Size: Support Concrete at rate poured
- G. Extent of Work: Provide at Footing and Flatwork perimeters, unless otherwise indicated.

**2.2 PLYWOOD FORMS**

- A. APA Grade: B-B Plyform
- B. Class: 1
- C. Thickness: As required by Concrete placement rate

**PART 2 - PRODUCTS**

**2.3 FORM TIES**

- A. Manufacturer: Bowman, Burke, Dayton, Richmond, or approved.
- B. Type: Plastic Cone recommended by Manufacturer for conditions of use.
- C. Break-back Distance from Concrete Face: 1 inch
- D. Do not use Wire Ties and Wood Spacers.

**2.4 EMBEDDED ITEMS**

- A. Steel Reinforcement: Refer to Section 03-20-00
- B. Anchor Bolts: Furnished by Steel Fabricators and Equipment Suppliers.

**2.5 FORM TREATMENT MATERIALS**

- A. For Wood Plank Forms: Clean Water
- B. For Plywood Forms: VOC-free, non-staining, chemical Form Release Compound of Contractor's choice.

**2.6 FORM JOINT CAULKING COMPOUND**

- A. Material: Latex Acrylic Sealant specified in Section 07-92-00.

**PART 3 - EXECUTION**

**3.1 PROTECTION**

- A. Protect other Work against damage and discoloration caused by Work of this Section.

**3.2 INSTALLATION - GENERAL**

- A. Conform to shapes, lines, and dimensions shown on Drawings.
- B. Brace and tie together to ensure that position and shape are maintained.
- C. At Concrete Flatwork directly over any Waterproof or Vapor Retarder Membranes, use Cradle, Pad, or Base-type Screed Supports that will not puncture Membrane. Do not drive Stakes through Membranes

(Cont.)

**PART 3 - EXECUTION**

**3.2 INSTALLATION – GENERAL (Cont.)**

- D. Make tight to prevent Concrete leakage.
- E. Arrange Joints as indicated or directed.
- F. Form any Surface Indentations shown on Drawings.
- G. Provide Access Openings as required for cleaning and inspection of Forms and Embedded Items prior to placing Concrete. Locate where not exposed to view.

**3.3 EARTH FORMS**

- A. Hand trim where necessary.
- B. Remove any loose Dirt.

**3.4 PLYWOOD FORMS**

- A. At Forms for Exposed Concrete, fill Form Panel joints with Form Joint Caulking Compound, and strike Compound flush with Panel on face adjacent to exposed Concrete, or cover Joints with thin, smooth, plastic, Pressure-sensitive Tape.
- B. Prevent Plywood end grain from forming Concrete exposed to view.

**3.5 BRACING**

- A. Provide as required to meet load requirements.
- B. Protect against undermining or settlement when placed on ground.
- C. Anchor as required to prevent upward or lateral Formwork movement during Concrete placement.

**3.6 FORM TIES**

- A. Unless otherwise indicated or approved, locate equidistant and symmetrical; align vertically and horizontally.
- B. At Exposed Concrete Forms seal Form Ties against leakage with Form Joint Caulking Compound.

**3.7 OPENINGS & CHASINGS**

- A. Provide Openings and Chasings of Slabs and Walls for Mechanical and Electrical Work. Sizes and locations as directed by Mechanical and Electrical Trades.

**PART 3 - EXECUTION**

**3.8 CHAMFERS**

- A. Except at Foundation Walls, at flush joints between adjacent materials, and elsewhere shown on Drawings; chamfer exposed external corners of Concrete with 3/4 inch triangular Wood Strips placed in Forms.

**3.9 ALLOWABLE TOLERANCES FOR CONCRETE**

- A. Variation from level:
  - 1. 1/4 inch in any 10 ft.
  - 2. Maximum over entire length: 1/2 inch
- B. Variation from plumb:
  - 1. 1/4 inch in any 10 ft.
  - 2. Maximum over entire length: 1 inch
- C. Variation in Cross Sectional Dimensions: Minus 1/4 inch; plus 1/2 inch
- D. Variation in Surface Tolerance: 1/8 inch in any 10 ft. measured with 10 ft. straight-edge.
- E. Maximum Deflection of Form Facing between Supports:  $0.0025 \times \text{Span}$
- F. Walls: Accurately size and locate within 1/8 inch plus or minus

**3.10 FORM TREATMENT**

- A. Wood Plank Forms: Wet thoroughly just before placing Concrete.
- B. Plywood Forms:
  - 1. Prior to each use: Apply Form Coating to contact surfaces in accordance with Manufacturer's instructions.
  - 2. When treating previously set Forms, prevent Coatings from covering Reinforcing Steel or existing Concrete where bond is required.
  - 3. Prevent Coatings from collecting in puddles.

**3.11 EMBEDDED ITEM INSTALLATION**

- A. Steel Reinforcement: Refer to Section 03-20-00.
- B. Anchor Bolts & Anchoring Devices:
  - 1. Set with Templates to assure accurate Bolt positioning.
  - 2. Secure in accordance with approved Setting Drawings.

(Cont.)

**PART 3 - EXECUTION**

**3.12 ADJUSTMENTS**

- A. Reposition to true alignment prior to, during, and after Concrete placement, if necessary.
- B. During Concrete placement, in areas where Formwork develops weakness, settlement, or distortion, stop Concrete placement, remove placed Concrete, and replace or strengthen Formwork.

**3.13 FORM REMOVAL**

- A. Leave Forms and Shoring in place until Concrete has attained sufficient strength to safely support own weight and imposed loads.
- B. Remove Forms at time and in manner to insure safety of Structure, and without Concrete surface damage.
- C. At exposed Concrete, Form-removal time shall be uniform to avoid color differences.
- D. Remove Top Forms from any sloping Concrete surfaces as soon as Concrete is self-supporting. Repair and finish, if necessary, and cure immediately.

**3.14 FORM CLEANING**

- A. Remove debris and foreign matter from Formwork prior to Concrete placement.
- B. Remove loose rust and foreign matter from reusable Hardware prior to installation into Formwork.

**3.15 FORM RE-USE**

- A. Withdraw projecting Nails and clean Concrete Form contact-surfaces. Replace with new material when necessary or when directed.
- B. Re-use Forms only when contact-surfaces equal those specified for original use.

**3.16 WASTE MANAGEMENT**

- A. Collect Formwork Trimmings, and place where directed for recycling.

**3.17 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 EXTENT OF WORK**

- A. Except where otherwise specified below, provide all required Steel Reinforcement.
- B. Drawings and Specifications indicate Contract Work.
- C. If Work adjustments are made because of hidden unacceptable soil conditions Contract Sum will be adjusted in accordance with Contract Conditions.

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Furnishing & placing Concrete Walk, Curb, & Gutter Reinforcement: Section 02-77-00
- B. Concrete Formwork: Section 03-10-00
- C. Cast in Place Concrete: Section 03-30-00

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.6 REFERENCED SPECIFICATIONS**

- A. Unless otherwise specified herein, conform to applicable requirements of Section 3 of ACI 301, Specifications for Concrete Construction, published by American Concrete Institute (ACI); 38800 Country Club Dr.; Farmington Hills, MI 48331; (248) 848-3800.

**1.7 SHOP & PLACEMENT DRAWINGS**

- A. Follow ACI 315 Detailing Manual, published by American Concrete Institute; 38800 Country Club Dr.; Farmington Hills, MI 48331; (248) 848-3700.
- B. Submit in accordance with Section 01-33-00.

**PART 1 - GENERAL**

**1.8 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage, deformation, and coverage by Mud or Ice.
- B. Tag each Piece or Bundle; indicate size, grade, and location.

**1.9 ADVANCE NOTICES**

- A. Notify Architect and Testing Lab at least 24 hours prior to covering Reinforcement so inspections can be made.

**PART 2 - PRODUCTS**

**2.1 BARS**

- A. Material: Steel
- B. Manufacturing Standard:
  - 1. If and where Welded: ASTM A-706
  - 2. All Other Bars: ASTM A-615
- C. Grade: 60
- D. Sizes: See Drawings.

**2.2 TIE WIRE**

- A. Material: Black annealed Steel
- B. Manufacturing Standard: ASTM A-82
- C. Minimum Size: 16 ga.

**2.3 ACCESSORIES**

- A. Material: Concrete, Ceramic, Plastic, or Metal. Hot-dip galvanize any Metal Accessories adjacent to exposed Concrete surfaces.
- B. Manufacturing Standard: Manual of Standard Practice, published by Concrete Reinforcing Steel Institute; 933 N. Plum Grove Rd.; Schaumburg, IL 60173; (874) 517-1206. Copies can be obtained from Institute or viewed at [www.crsi.org](http://www.crsi.org)
- C. Extent of Work: Provide all Accessories necessary for proper Reinforcement placement, spacing, support, and fastening.

**PART 2 - PRODUCTS**

**2.4 FABRICATION**

- A. Follow Manual of Standard Practice published by Concrete Reinforcing Steel Institute.

**2.5 ALLOWABLE FABRICATION VARIATION FROM DRAWING DIMENSIONS**

- A. Sheared Bar Lengths: Plus or Minus 1 inch
- B. Tie Dimensions: Plus or minus 1/2 inch
- C. All other Bend Dimensions: Plus or minus 1 inch

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that surfaces to receive Reinforcement are accurately sized and located, square, plumb, rigid, secure, and otherwise accurately prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. General: Conform to International Building Code (IBC) paragraphs hereinafter named and amplified.
- B. Bending:
  - 1. Conform to Code paragraph 1907.3
  - 2. Bend Bars without heat.
  - 3. Field bending partially embedded Bars, not permitted without Architect's approval.
- C. Placing:
  - 1. Conform to Code paragraph 1907.5
  - 2. Secure against displacement.

(Cont.)



**PART 3 - EXECUTION**

**3.3 INSTALLATION (Cont.)**

- D. Spacing:
  - 1. Conform to Code paragraph 1907.6
  - 2. Clear distance between parallel Bars, including splices, unless otherwise permitted by Code, not less than:
    - a. Nominal Bar diameter
    - b. 1-1/2 times maximum Concrete Aggregate size
    - c. 1 inch
- E. Splicing:
  - 1. Conform to Code paragraph 1907 & ACI 318, as applicable.
  - 2. Do not weld or tack-weld Reinforcement Splices.
  - 3. Minimum Lap at Splices: 48 Bar diameters; 24 inches minimum.
- F. Protective Concrete Covering:
  - 1. Conform to Code paragraph 1907.5.2.1
    - a. Concrete cast against and permanently exposed to Ground: 3 inches
    - b. Concrete not cast against Ground, but exposed to Ground or Weather:
      - 1. No. 6 through No. 18 Bars, if any: 2 inches
      - 2. No. 5 Bars and smaller, if any: 1-1/2 inches
      - 3. W31 or D31 Wire or smaller, if any: 1-1/2 inches
    - c. Concrete neither in contact with Ground nor exposed to Weather:
      - 1. In Slabs, Walls, or Joists, if any:
        - a. No. 14 & No. 18 Bars, if any: 1-1/2 inches
        - b. No. 11 Bars and smaller: 3/4 inch
      - 2. In Beams & Columns, if any:
        - a. Primary Reinforcement & Ties, if any: 1-1/2 inches

**3.4 SPECIAL REINFORCEMENT INSTALLATION, unless otherwise shown on Drawings**

- A. Reinforcement at Concrete Wall Corners & Intersections:
  - 1. Splice Horizontal Reinforcing with Splice Bars and Corner Bars; space and size to match horizontal Wall Reinforcing.
  - 2. Extend beyond Corner or Intersection 48 Bar diameters; 24 inches minimum.
- B. Reinforcement at Concrete Wall Openings:
  - 1. Provide 2 each Bars around Openings as follows:
    - a. Vertical Bars: Extend over full height of Wall.
    - b. Horizontal Bars:
      - 1. Where Possible: Extend Bars 24 inches minimum beyond Opening corners.
      - 2. Where Not Possible: Hook Bar ends

(Cont.)

**PART 3 - EXECUTION**

**3.5 SPECIAL REINFORCEMENT INSTALLATION, unless otherwise shown on Drawings (Cont.)**

- A. Reinforcing Bar for Electrical Grounding:
  - 1. Provide three 20 ft. long #4 independent Grounding Bars which overlap lowest longitudinal Building Foundation Reinforcing Bars. Secure Grounding Bars to Foundation Bars.
  - 2. Bend Grounding Bars upward and extend vertically at least 12 inches above top of Sill Plate so Electrician can make Grounding Connection. Protect exposed Grounding Bars with Rigid PVC Pipe.
  - 3. Locate Grounding Bars as close as possible to Electrical Service.
  - 4. Coordinate with Electrical Subcontractor.
- B. Reinforcement at Concrete Floor-slab Re-entrant Corners:
  - 1. Provide two, 48 inch long, #4 Bars diagonally across Re-entrant Corners.

**3.6 ALLOWABLE PLACEMENT VARIATION FROM DRAWING DIMENSIONS**

- A. Concrete Cover: Plus or minus 1/4 inch
- B. Spacing between Bars: 1/4 inch
- C. Transverse Bars: Space evenly within 2 inches of stated separation.
- D. Bar relocation to avoid interference with other Reinforcement, Conduits, or Embedded Items: 1 Bar diameter, unless otherwise approved by Architect.

**3.7 WASTE MANAGEMENT**

- A. Collect Reinforcement Trimmings, and place where directed for recycling.

**3.8 PRODUCT CLEANING & REPAIRING**

- A. Prior to Concrete placement, remove loose flaky rust, mud, oil, and other bond-reducing Coatings.
- B. 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.
- C. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 EXTENT OF WORK**

- A. Drawings and Specifications indicate Contract Work.
- B. If Work adjustments are made because of hidden unacceptable soil conditions Contract Sum will be adjusted in accordance with Contract Conditions.

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Laboratory Testing of Concrete: Section 01-45-30
- B. Concrete Walks, Curbs, & Gutters: Section 02-77-00
- C. Concrete Formwork: Section 03-10-00
- D. Concrete Reinforcement: Section 03-20-00
- E. Metal Decking to receive Concrete: Section 05-30-00

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 REFERENCED SPECIFICATIONS**

- A. Unless otherwise specified herein, conform to applicable requirements of Sections 1, 4, & 5 of ACI 301 - Specifications for Concrete Construction, published by American Concrete Institute (ACI); 38800 Country Club Dr.; Farmington Hills, MI 48331; (248) 848-3800.

**1.6 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.7 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.
- B. Conform to ASTM C-94.

**PART 1 - GENERAL**

**1.8 WEATHER REQUIREMENTS**

A. General:

1. Follow referenced Standard Specification for Cold & Warm Weather Concreting, ACI 306 & 305 respectively.

B. Cold Weather:

1. Do not place Concrete during cold weather (40°F or less) until Protection Materials and Equipment are at or near Project Site.
2. Place no Concrete on frozen Subgrade.
3. Remove Ice and Snow from Reinforcing, Forms, Embedded Items, and other Contact Surfaces.
4. Raise and maintain temperature of all Surfaces in contact with Concrete above 40°F prior to Concrete placement.
5. Do not use Salts or Chemical Admixtures to prevent Concrete freezing.
6. Terminate any Water Curing at least 24 hours before any anticipated freezing temperatures.
7. Locate and direct any Heaters or Ducts so as not to cause overheating or over-drying of Concrete or create fire hazards. Directly exhaust Flue Gases from any Combustion Heaters to outside of any enclosures.
8. Following protection period, allow Concrete to cool gradually.
9. Assume responsibility, including costs, for testing suspected frozen Concrete.
10. Remove and replace freeze-damaged Concrete at Contractor's expense.

C. Warm Weather:

1. When Air temperature exceeds 85°F or when Wind exceeds 10 mph place Concrete in accordance with the following requirements:
  - a. Maximum Concrete temperature at time of placement: 70°F.
  - b. Mix Concrete minimum possible time, and place as soon as possible thereafter.
  - c. Maximum Mixing Time:
    1. When Air-temperature is between 85°F & 90°F: 75 minutes
    2. When Air-temperature exceeds 90°F: 60 minutes
  - d. Sprinkle Forms, Reinforcing, Embedded Items, and Subgrade with Cool Water immediately prior to Concrete placement.
  - e. Protect unstripped Formwork and exposed Concrete surfaces against excessive drying with water spray or other approved method.
  - f. Assume responsibility, including costs, for testing damage-suspected Concrete.
  - g. Remove and replace heat-damaged or wind-damaged Concrete at Contractor's expense.

**1.9 ADVANCE NOTICES**

- A. Notify Architect and Testing Lab at least 24 hours before intended Concrete placement.
- B. Place no Concrete until Formwork and Reinforcement have been inspected.

**PART 2 - PRODUCTS**

**2.1 CONCRETE FLOOR SLAB VAPOR BARRIER**

- A. Manufacturer & Brand: Stego Industries Stego Wrap, Raven VaporBlock, or approved.
- B. Material: Polyolefin Membrane
- C. Manufacturing Standard: ASTM E-1745 class A
- D. Minimum Thickness: 15 mils
- E. Extent of Work: Provide directly beneath on-grade Interior Concrete Flatwork.

**2.2 CONCRETE PRODUCTS - GENERAL**

- A. Cements, Aggregates, Pozzolans, etc. for Exposed Concrete shall come from same respective sources.
- B. Prohibited Admixtures: Calcium Chloride, Thyocyanates, and any others containing more than 0.05% Chloride Ions.

**2.3 PORTLAND CEMENT**

- A. Manufacturing Standard: ASTM C-150
- B. Type: I-II

**2.4 AGGREGATE**

- A. Manufacturing Standard: ASTM C-33
- B. Maximum Size: 1-1/2 inches and not more than one-fifth of narrowest dimension between sides of Forms, one-third of depth of Flatwork, or three-fourths of narrowest space between Reinforcing Bars.

**2.5 FLY ASH**

- A. Manufacturing Standard: ASTM C-618
- B. Class: F
- C. Maximum Ignition Loss: 3%
- D. Maximum Fly Ash Content: 20% of Cement weight
- E. Maximum Cement Substitution: 20 %
- F. Extent of Work: May be used at Contractor's option.

(Cont.)

**PART 2 - PRODUCTS**

**2.6 ENTRAINED AIR**

- A. Manufacturing Standard: ASTM C-260
- B. Mixture (in percentage of Concrete Volume):
  - 1. At Interior Concrete Flatwork subjected to Vehicular Traffic: 3% max.
  - 2. At all other Interior Concrete Flatwork: 2% to 4%
  - 3. At Exterior Concrete Flatwork: 3% to 6%
- C. Extent of Work: Provide in all Concrete exposed to Freeze-Thaw Cycles while in wet condition during construction or during subsequent use.

**2.7 WATER REDUCING ADMIXTURES**

- A. Manufacturing Standard: ASTM C-494
- B. Type: A
- C. Material: Shall not increase Concrete-shrinkage or promote Water-bleeding
- D. Extent of Work: May be used at Contractor's option.

**2.8 BONDING AGENT**

- A. At Dry Surfaces: Dayton Superior Day-Chem Ad Bond (J-40), Sonneborn Sonocrete, L&M Everbond, US Spec Acrylcoat, or approved.
- B. At Damp Surfaces: Euclid Euco Epoxy 452 MV or 620, Sika Sikadur Hi-Mod, US Spec Slow-Bond 6500, or approved.

**2.9 EXPANSION JOINT FILLER**

- A. Material: Asphalt-impregnated Cane Fiber
- B. Manufacturing Standard: ASTM D-1751
- C. Thickness: 3/8 inch
- D. Depth: As required to position Filler top 1/4 inch below Slab top.

**2.10 EPOXY ADHESIVE**

- A. Manufacturer & Brand: Hilti HIT RE 500SD, Simpson Strong Tie SET-3G, or approved.
- B. Manufacturing Standard: ASTM C-881
- C. Type: 2-component for use on dry or damp surfaces
- D. Allowable Temperature Range: Follow Manufacturer's instructions.

(Cont.)

**PART 2 - PRODUCTS**

**2.10 EPOXY ADHESIVE (Cont.)**

- E. Hazardous Material Handling: Follow Manufacturer's instructions.
- F. Extent of Work:
  - 1. Around Reinforcing Dowels, Anchors, etc. where anchoring new Work to existing.
  - 2. Elsewhere shown on Drawings.

**2.11 NON-SHRINK GROUT**

- A. Manufacturer & Brand: Euclid Euco-NS, L&M Crystx, Master Builders Masterflow 928, Sonneborn SonogROUT, US Grout Five Star Grout, US Spec GP Grout, or approved.
- B. Manufacturing Standard: ASTM C-1107
- C. Minimum 7 day Compressive Strength: 5000 psi
- D. Positive Expansion: Demonstrate compliance with ASTM C-827
- E. Extent of Work:
  - 1. Under Column Base Plates
  - 2. Elsewhere shown on Drawings.

**2.12 STANDARD DRY PACK GROUT**

- A. Parts by volume:
  - 1. Cement: 1
  - 2. Lime: 1/4
  - 3. Fine Aggregate: 3
  - 4. Pea Gravel: 1-1/2
  - 5. Water: Minimum amount to produce 5000 psi compressive strength at 28 days, and to provide pouring consistency without Aggregate segregation.
- B. Extent of Work:
  - 1. Around any Pipes, Conduit, or Ducts passing through Concrete Flatwork or Walls.
  - 2. Around any other Penetrations through Concrete Flatwork or Walls.
  - 3. Elsewhere shown on Drawings.

**2.13 FLOOR FILLER**

- A. Manufacturer & Brand: Ardex Feather Finish, US Spec Floatcoat, or approved.
- B. Extent of Work: Provide at any "Birdbaths", and over Concrete Flatwork which is too rough or too untrue to provide acceptable Substrate for Finish Flooring,

**PART 2 - PRODUCTS**

**2.14 CURING COMPOUNDS**

- A. At Interior Flatwork:
  - 1. Type: Clear, colorless, water-base, VOC-compliant, and acceptable to adjacent Flooring Manufacturer, if any.
  - 2. Manufacturer: L&M, Meadows, Sonneborn, US Spec, or approved.
  - 3. Manufacturing Standard: ASTM C-1315, Type 1, Class A
- B. At Exterior Flatwork:
  - 1. Type: Non-yellowing, VOC-compliant, and with disappearing White Pigment.
  - 2. Manufacturer: L&M, Meadows, Sonneborn, US Spec, or approved.
  - 3. Manufacturing Standard: ASTM C-1315, Type II, Class A

**2.15 HARDENING COMPOUNDS**

- A. Liquid Densifier Type:
  - 1. Manufacturer & Brand: Curecrete Ashford Formula, Euclid Euco Diamond Hard, L&M Seal Hard, or approved.
  - 2. Sheen: Low
  - 3. Extent of Work: Provide over exposed Concrete Flatwork to receive Vehicular Traffic.
- B. Standard Duty Type:
  - 1. Manufacturer & Brand: A.C. Horn Hornolith, L&M Fluohard, Nox-Crete Harbaton, Sonneborn Lapidolith, or approved.
  - 2. Extent of Work: Provide over all uncovered Interior Concrete Flatwork. except where Liquid Densifier type Compound is provided.

**2.16 PROTECTION PAPER**

- A. Material: Heavy-duty, scuff-proof, non-staining Reinforced Paper.
- B. Extent of Work: Apply over uncovered Flatwork subject to discoloration or damage.

**2.17 OTHER INGREDIENTS**

- A. Conform to Building Code.

(Cont.)



**PART 2 - PRODUCTS**

**2.18 MIXING CONCRETE**

- A. General:
  - 1. Readymix type conforming to ASTM C-94.
  - 2. Assume responsibility for Mix design and Product performance.
- B. Concrete Design Strength:
  - 1. Minimum Density: 145 pcf, plus or minus 5%
  - 2. Minimum 28 day Compressive Strengths & Locations: See Structural Notes on Drawings.
- C. Maximum Concrete Slump:
  - 1. 4 inches (plus or minus 1 inch) at any time is maximum.
  - 2. Concrete with greater Slump, or Concrete showing Bleeding or Aggregate Separation as Concrete comes out of Delivery Truck, will be rejected and must be replaced.
  - 3. Add Water only with Architect's permission.
  - 4. Do not add Water after acceptable Slump Test has been obtained.
  - 5. Water-content in Exposed Concrete shall be constant from batch to batch.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Formwork, Reinforcement, and Embedded Items are accurately and securely placed, clean, water and frost-free, and ready to receive Concrete.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 SURFACE PREPARATION**

- A. Remove Foreign Matter from surfaces and areas to receive Concrete.
- B. Sprinkle Subgrade and other porous surfaces with Water to eliminate suction.

**PART 3 - EXECUTION**

**3.4 VAPOR BARRIER INSTALLATION**

- A. Follow Manufacturer's instructions and ASTM E-1643.
- B. Install Barrier with long dimension parallel with Concrete-pour direction.
- C. Lap Joints 6 inches minimum, and turn-up 12 inches minimum to Slab top at Vertical Surfaces.
- D. Seal Joints and Holes with Mastic or Tape before placing Concrete.
- E. Do not puncture Barrier with Concrete Placement Screed Stakes or other similar Devices.

**3.5 CONCRETE BOND**

- A. Coat Bonding Agent over existing Concrete to be joined with new Concrete.
- B. Follow Manufacturer's instructions.

**3.6 CONSTRUCTION JOINTS IN WALLS, unless otherwise shown on Drawings**

- A. At any exposed Horizontal Joints, apply 2x6 Wood Strip level to inside of Form cast against exposed Concrete face. Stop Concrete pour approximately 1/2 inch above lower edge of Strip. Remove Strip prior to continuing Concrete placement.
- B. Keyed Joints:
  - 1. Minimum Depth: 1-1/2 inches
  - 2. Provide at Joints between Walls, Slabs, and Footings.
- C. Reinforcement: Continue across Joint, unless otherwise shown on Drawings.

**3.7 CONSTRUCTION JOINTS IN FLATWORK**

- A. Form to true, straight lines, and with adjacent Flatwork Panels flush at Joints.
- B. Make Panels as close to square as possible.
- C. Do not extend Reinforcement through Joints.
- D. Except at Expansion Joints, key adjacent Joints.
- E. At Keyed Joints, increase Slab thickness by 2 inches and extend for 12 inches beyond each side of Joint.
- F. Joint Spacing in each direction: Unless spacing is shown on Drawings, do not exceed 30 times Slab thickness.

(Cont.)

**PART 3 - EXECUTION**

**3.8 PLACING CONCRETE**

- A. Convey and place by methods which will prevent Material separation and loss.
- B. Place Concrete to receive Liquid Densifier type Hardener in accordance with Hardener Manufacturer's instructions.
- C. At Walls deposit Concrete in 24 inch deep maximum horizontal layers. Do not deposit with inclined seams. Do not allow Base Layers to lose plasticity prior to placing Succeeding Layers.
- D. Do not convey pneumatically-placed Concrete through Aluminum Pipe.
- E. Do not retemper or use set Concrete.
- F. Do not disturb or displace Reinforcement, Embedded Items or Formwork during Concrete placement.
- G. Maximum height of vertical drop without use of trunk, placement ports in sides of Formwork, or other approved method is 5 ft.
- H. If and when under-water Concrete placement is approved, deposit fresh Concrete into mass of previously placed Concrete causing Water to be displaced with minimum Concrete surface disturbance.

**3.9 CONSOLIDATING CONCRETE**

- A. Employ mechanical, high-frequency Vibrators to consolidate Concrete around Reinforcement, into corners and angles of Forms, and to exclude rock pockets, air bubbles, and honeycomb.
- B. Hold Vibrator in one spot no longer than 15 seconds; keep in constant motion, insert and withdraw at points approximately 18 inches o.c.
- C. Maintain Vibrator in vertical position when penetrating Concrete.
- D. Transporting Concrete with Vibrator not permitted.
- E. Maintain spare Vibrator at jobsite during Concrete placement.

**3.10 FINISHING FORM TIE HOLES**

- A. In Concrete Exposed to View:
  - 1. After Form Tie removal, fill Holes with Standard Dry Pack Grout mixed as dry as feasible; ram Grout solid, and finish flush with adjacent Concrete Surface.
- B. Elsewhere:
  - 1. No plugging required after Form Tie removal

(Cont.)

**PART 3 - EXECUTION**

**3.11 VOIDS & GRAVEL POCKETS**

- A. Repair where necessary and where directed by Architect.
- B. Satisfactory repair of Exposed Concrete is virtually impossible; therefore take all necessary precautions to assure that repairs are unnecessary. If imperfections are sufficiently objectionable, replace Work in question when directed.

**3.12 EXPOSED CONCRETE WALL FINISHES**

- A. Formed Surfaces Exposed to View:
  - 1. Remove Concrete Fins.
  - 2. Patch Imperfections to match adjacent Surface.
  - 3. Leave Surfaces clean and smooth.
- B. Unformed Surfaces Exposed to View:
  - 1. Finish as required to match adjacent Surface, unless otherwise shown on Drawings.

**3.13 CONCRETE FLATWORK FINISHES**

- A. Required Preparation Work:
  - 1. Screed all Flatwork to true levels or slopes.
  - 2. Prior to finishing Concrete, remove any accumulated Bleed Water. Do not add "finishing water".
  - 3. Evenly slope to any Drain at 3/16 inch per ft., unless otherwise shown on Drawings.
- B. Non-slip Finish:
  - 1. Screed and tamp Concrete to bring Fine Particles to surface.
  - 2. Bring to true surfaces with Wood or Carpet Float.
  - 3. Slightly roughen Surfaces perpendicular to main traffic-route with wet, fine-hair Broom.
  - 4. Extent of Work: Provide at exterior Flatwork, unless otherwise shown on Drawings.
- C. Smooth-troweled Finish:
  - 1. Finish by Hand or Machine Trowel to hard, dense surface, free from Trowel Marks.
  - 2. Do not absorb Wet Spots with Neat Cement or Cement-Sand Mixture, and do not use Chemical Dryers.
  - 3. Wait until Surfaces are dry enough for proper troweling.
  - 4. Trowel Slabs level or to true slopes.
  - 5. Extent of Work: Provide at all Interior Flatwork, unless otherwise specified.
- D. Slabs to receive Liquid Densifier type Hardener:
  - 1. Follow Hardener Manufacturer's instructions.

**3.14 ALLOWABLE FLATWORK TOLERANCES**

- A. All Flatwork: True within 1/4 inch per 10 ft.

**PART 3 - EXECUTION**

**3.15 CURING**

- A. Prevent rapid or non-uniform Exposed Concrete drying.
- B. Minimum Curing Periods:
  - 1. High-early Strength Cement, if used: 3 days
  - 2. All other Cement: 7 days
- C. Minimum Curing Air Temperature: 50° F
- D. Walls: Keep damp for at least 14 days following Concrete placement.
- E. Flatwork: Immediately after Slabs are finished, treat Concrete with Curing Compound applied in accordance with Manufacturer's instructions.

**3.16 NON-SHRINK GROUT INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Do not retemper set-Grout.
- C. Saturate Concrete contact-surfaces prior to grouting. Remove excess Water.
- D. Thoroughly compact Grout free of Air Pockets. Do not vibrate Grout.
- E. Cure Grout with Moisture for at least 24 hours.
- F. Do not remove Leveling Shims, if any, until 48 hours after Grout-placement. After Shim-removal fill Voids with Standard Dry Pack Grout.

**3.17 STANDARD DRY PACK GROUT INSTALLATION**

- A. Do not retemper set-Grout.
- B. Saturate Concrete contact-surfaces prior to grouting; remove excess Water.
- C. Thoroughly consolidate Grout free of Air Pockets. Do not vibrate Grout.
- D. Cure Grout with Moisture for at least 24 hours.

**3.18 EPOXY ADHESIVE APPLICATION**

- A. Follow Manufacturer's instructions.

(Cont.)

**PART 3 - EXECUTION**

**3.19 SAWN CONTRACTION JOINTS IN FLATWORK**

- A. In Flatwork subject to use by Vehicular Traffic provide the following:
  - 1. Using "Wet Blade" Saw, cut Joints through at least 25% of Slab depth. Do not "dry-saw" without Water. Do not use Grooving Tools or Joint-forming Strips.
  - 2. Joint Spacing: Do not exceed 30 times Slab thickness in both directions.
  - 3. Apply Curing Compound to "cut" surfaces as soon as possible after sawing.
- B. Optional Method: Contractor may, at Contractor's option, substitute the following:
  - 1. System: Husqvarna Soff-Cut; (800) 288-5040; or approved.
  - 2. Method: In accordance with System Manufacturer's instructions, and within 0 to 2 hours following Concrete finishing, saw-cut Joints at least 10% of Slab thickness (1 inch min.)
- C. Open Joint Filling:
  - 1. After waiting as long as possible for Slabs to shrink, fill Joints with semi-rigid Epoxy Joint Filler with A-80 Shore Hardness, which is capable of supporting heavy wheel loads while not becoming hard or brittle with age. Install Filler full depth of Joint without using Backer Rod. Install Filler flush with Slab surface, and finish smooth and dense.

**3.20 FLOOR FILLER APPLICATION**

- A. Prior to Filler application, prime Floor with Asphalt Emulsion.
- B. Mix Filler with Asphalt Emulsion where necessary to improve bond.

**3.21 HARDENER APPLICATION**

- A. Follow Manufacturer's instructions.
- B. Clean Floors immediately prior to applying Hardener.

(Cont.)

**PART 3 - EXECUTION**

**3.22 DEFECTIVE WORK**

- A. If Tests specified in Section 01-45-30 indicate that Concrete has failed to meet Specifications, replace Substandard Material, unless otherwise directed by Architect.
- B. Additionally, remove and replace the following:
  - 1. Loose Topping Slabs
  - 2. Surfaces which show excessive Shrinkage Cracks or Cracking.
  - 3. Flatwork which does not drain properly
  - 4. Curled or Warped Slabs
  - 5. Rain-damaged or Scaled Concrete
  - 6. Concrete exceeding specified allowable tolerances
  - 7. Work determined by Architect to be unacceptable
- C. On Surfaces scheduled to receive Finish Covering remove, by grinding if necessary, any Defects of sufficient magnitude to show through Covering.
- D. Remove and replace honeycombed and other defective Concrete down to sound Concrete and replace. If chipping is necessary, shape Edges perpendicular to Surface or slightly undercut. Do not feather Edges.

**3.23 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**3.24 PROTECTING COMPLETED WORK**

- A. Flatwork specified to receive Protection Paper:
  - 1. Cover with Protection Paper secured in position, and otherwise protect Concrete against damage and discoloration.
  - 2. Note: Liquid Densifier type Hardener has light colored finish, and can be easily discolored.
- B. All Other Work:
  - 1. Protect against damage and discoloration.

**END OF SECTION**

**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 WORK INCLUDED**

- A. In accordance with governing laws, regulations, codes, Design Loads listed in Structural Notes on Drawings, and requirements specified in Section 01-11-50; design, engineer, fabricate, and install Structural Steel for Factory Engineered Building as specified herein and as shown on Drawings.

**1.3 EXTENT OF WORK**

- A. Structural Steel Subcontractor:
  - 1. Provide all Steel Work indicated on Structural Drawings, even if also shown on Architectural Drawings, except where specifically noted to be provided by other Trades.
- B. Miscellaneous Fabricated Steel Subcontractor:
  - 1. Except for Related Work Items specified below, provide all other Steel Work.

**1.4 PRODUCTS FURNISHED, BUT INSTALLED UNDER OTHER SECTIONS**

- A. Anchor Bolts and loose Bearing Plates installed under Section 03-10-00.

**1.5 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Grouting under Base & Bearing Plates: Section 03-30-00
- B. Steel Decking: Section 05-30-00
- C. Miscellaneous Fabricated Steel: Section 05-50-00
- D. Field Painting: Section 09-90-00
- E. Factory-engineered Buildings: Section 13-12-10
- F. Crane Rails: Section 14-60-00

**1.6 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.



**PART 1 - GENERAL**

**1.7 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.8 REFERENCED SPECIFICATIONS**

- A. Except as modified by these Specifications, follow AISC Specification and Code of Standard Practice for Steel Buildings. Code may be obtained from Institute.

**1.9 ABBREVIATIONS**

- A. **AISC:** American Institute of Steel Construction; One East Wacker Dr.; Suite 700; Chicago, IL 60601-1802; (866) 275-2472.
- B. **ANSI:** American National Standards Institute; 1819 L St. NW; 6<sup>th</sup> Floor; Washington DC 20036; (202) 293-8020.
- C. **ASCE:** American Society of Civil Engineers; 1801 Alexander Bell Dr.; Reston, VA 20191-4400; (800) 548-2723
- D. **ASTM:** American Society for Testing and Materials; 100 Barr Harbor Dr.; West Conshohocken, PA 19428; (610) 832-9585
- E. **AWS:** American Welding Society; 8669 Doral Blvd.; Suite 130; Doral, FL 33166; (305) 443-9353.

**1.10 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Indicate Shop and Erection Details, including Cuts, Copes, Connections, Holes, Threaded Fasteners, and Welds.
- C. Indicate Shop and Field Welds by AWS Welding Symbols.
- D. Illustrate erection procedures and sequence.
- E. Furnish Anchor Bolt Templates, Setting Drawings, and Installation Details.

**1.11 QUALIFICATIONS**

- A. Steel Fabricator & Steel Erector:
  - 1. Not less than 5 years experience in work of this type.
- B. Welders:
  - 1. Welders must be qualified for Welds to be performed in accordance with AWS D1.1 requirements.
  - 2. For each Welder submit, from approved Independent Laboratory or Inspection Service, Qualification Test Reports not older than 1 year.

**PART 1 - GENERAL**

**1.12 CERTIFICATES OF COMPLIANCE**

- A. Submit 2 copies of Manufacturers' Specification Compliance Certificates for each of the following:
  - 1. Structural Steel Sections
  - 2. Fasteners

**1.13 PRODUCT DELIVERY**

- A. Deliver to Jobsite in accordance with approved Progress Schedule and in proper erection sequence.
- B. Include all required Bolts and other Fastening Devices.

**1.14 PRODUCT STORAGE & HANDLING**

- A. Store Structural Steel Members above ground on Platforms, Skids, or other approved Supports.
- B. Store any Hot-dip Galvanized Steel Items with air-space between adjacent Items.
- C. Store other Materials in weather-tight and dry locations.
- D. Store packaged Materials in original, unbroken Containers.
- E. Protect against corrosion and damage.
- F. Permit easy access for identification and inspection of Stored Products.

**1.15 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**PART 2 - PRODUCTS**

**2.1 STEEL WIDE FLANGE SHAPES**

- A. Manufacturing Standard: ASTM A-992
- B. Minimum Yield Strength: 50 ksi

**PART 2 - PRODUCTS**

**2.2 OTHER STEEL BEAMS & PURLINS**

- A. Manufacturing Standard: ASTM A-572
- B. Minimum Yield Strength: 50 ksi

**2.3 ALL OTHER STEEL SHAPES, BARS, & PLATES**

- A. Manufacturing Standard: ASTM A-36 or A-572
- B. Minimum Yield Strength: 36 ksi

**2.4 STEEL RODS**

- A. Manufacturing Standard ASTM A-36
- B. Minimum Yield Strength: 36 ksi
- C. Diameter: See Drawings

**2.5 HIGH-STRENGTH THREADED FASTENERS**

- A. Manufacturing Standard: ASTM F-3125
- B. Size & Spacing: See Drawings
- C. Finish: Manufacturer's standard
- D. Extent of Work: Provide where shown on Drawings.

**2.6 STANDARD STRENGTH THREADED FASTENERS**

- A. Manufacturing Standard:
  - 1. Bolts & Nuts: ASTM A 307, Grade A
  - 2. Plain Washers: ANSI Standard B 27.2
  - 3. Beveled Washers: ANSI Standard B 27.4
- B. Size & Spacing: See Drawings
- C. Finish: Manufacturer's standard
- D. Extent of Work: Provide for all Work, except where High-Strength Threaded Fasteners are required.

**2.7 ANCHOR BOLTS**

- A. Manufacturing Standard ASTM F-1554
- B. Minimum Yield Strength: 36 ksi
- C. Size & Spacing: See Drawings

**PART 2 - PRODUCTS**

**2.8 WELDING ELECTRODES**

- A. Series: E-70xx
- B. Type: Satisfy conditions of use

**2.9 FABRICATION**

- A. General:
  - 1. Comply with Referenced Specifications.
  - 2. Shop-fabricate and Shop-assemble Members where practicable.
  - 3. Mark and match-mark Members for accurate field-assembly.
  - 4. If and where exposed to view, remove any Run-off Tabs or other Temporary Items.
- B. Bolt Holes:
  - 1. Fabricate Holes necessary for securing other Work to Structural Steel. Cut, drill, or punch Holes perpendicular to Member Surface. Do not flame-cut or enlarge Holes by burning.
- C. Bearing Plates:
  - 1. Provide Bearing Plates under Members resting on Footings, Piers, or Walls. Attach Bearing Plates or ship loose at Contractor's option.

**2.10 FABRICATION TOLERANCES**

- A. Maximum deviation of individual Members from dimensions shown on Drawings as follows:
  - 1. Overall length of Members with both ends finished for compact bearing: 1/32 inch
  - 2. Overall length of Members without finished ends:
    - a. For Members up to 30 ft. long: 1/16 inch
    - b. For Members over 30 ft. long: 1/8 inch
  - 3. Compressive Structural Member Straightness: 1/1000 of axial length between Lateral Support points
- B. Twists, Bends, & Kinks: Unacceptable

(Cont.)

**PART 2 - PRODUCTS**

**2.11 SHOP TREATMENT**

- A. Surface Preparation:
  - 1. Remove Grease, Oil, Dirt, loose Rust, loose Mill Scale, and any other bond-reducing Materials.
- B. Within 8 hours of Surface Preparation, apply the following:
  - 1. Oil Treatment:
    - a. Material: Oil-based, rust-inhibiting Coating containing no Metallic Pigment.
    - b. Manufacturer & Brand: Exxon Rust-Ban 394, Houghton Rust-Veto 342, or approved.
    - c. Extent of Work: Provide at contact faces of Steel to be grouted, such as Column Base Plates.
  - 2. Paint Treatment:
    - a. Paint with Rust Inhibiting Primer specified in Section 09-90-00.
    - b. Minimum Dry Film Thickness of Primer: 1.0 mil
    - c. Do not apply Primer at the following:
      - 1. Within 2 inches of Surfaces to be field welded.
      - 2. Surfaces to be encased in Concrete.
      - 3. Surfaces to receive Oil Treatment specified above.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that surfaces to receive Structural Steel are accurately sized and located, sound, true, even, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 ERECTION, GENERAL**

- A. Follow Referenced Specification, except as modified herein.

**PART 3 - EXECUTION**

**3.4 BEARING & BASE PLATE INSTALLATION**

- A. Set Plates attached to Members and those requiring Hoisting Equipment to lift.
- B. Align and level with Wedges, Shims, or Leveling Nuts.

**3.5 STRUCTURAL STEEL ERECTION**

- A. Clean contacting bearing surfaces prior to assembling.
- B. Accurately assemble to lines and elevations indicated.
- C. Bring abutting surfaces of Compression Members into contact prior to fastening Splices.
- D. Prior to fastening, align and adjust Frame Components within erection tolerances specified below.
- E. Splices permitted only where indicated.

**3.6 BOLTING**

- A. Erection Bolts used in welded construction may be tightened and left in place, or removed and holes plug welded at Contractor's option.
- B. Tighten any High-Strength Bolts in accordance with AISC "Specifications for Structural Joints using ASTM A-3125 or A-490 Bolts", employing method of Contractor's choice.

**3.7 WELDING**

- A. Follow Referenced Specifications.
- B. Unless otherwise shown on Drawings:
  - 1. Type: Fillet
  - 2. Size: 1/16 inch thinner than thinnest Member being welded
  - 3. Length: Full-length of Connecting Surfaces

**3.8 FIELD CUTTING**

- A. Do not correct fabrication errors by gas-cutting without Architect's prior approval.

**3.9 ALLOWABLE ERECTION TOLERANCES**

- A. Follow Referenced Specifications.

**PART 3 - EXECUTION**

**3.10 BRACING**

- A. Maintain Temporary Bracing as required by ASCE 37-02 until permanent Structural Members required for Lateral Stability have been installed and accepted by Architect.

**3.11 FIELD INSPECTION**

- A. Do not remove Staging or Platforms before Field Connections are inspected or tested.
- B. Do no welding until Surface to be welded and Filler Metal to be used have been inspected and approved.
- C. Refer to Section 01-45-30 for inspection and testing details.

**3.12 TOUCH UP PAINTING**

- A. Touch up Field Connections and damaged Shop Treatment areas as erection proceeds.
- B. Immediately prior to final covering, remove Rust and retreat any Members showing evidence of Rust through Shop Treatment over approximately 5% or more of total Shop Treatment area.

**3.13 WASTE MANAGEMENT**

- A. Collect Scrap, Shipping Pallets, & Packaging Waste; and place where directed for recycling.

**3.14 PRODUCT CLEANING & REPAIRING**

- A. Remove loose Rust, heavy Mill Scale, Oil, Dirt, and other bond-reducing Foreign Substances from Members scheduled to receive Finish Painting, or other direct-to-steel Coatings.
- B. 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.
- C. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 WORK INCLUDED**

- A. In accordance with governing laws, regulations, and codes; Design Loads listed in Structural Notes on Drawings; and requirements specified in Section 01-11-50; design, engineer, fabricate, and install Office Area & Canopy Roof Decking as specified herein and as shown on Drawings.

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Structural Steel Deck Supports: Section 05-10-00
- B. Roof Insulation & Single Ply Roofing: Section 07-53-00
- C. Field Painting of Exposed Decking: Section 09-90-00

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.6 DESIGN LOAD REQUIREMENTS**

- A. Decking shall be designed by Engineer licensed to practice in Oregon.
- B. Support Design Loads specified in Structural Notes on Drawings.

**1.7 SHOP & ERECTION DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show layout, framing supports, dimensions, complete construction details and installation methods, including accessories, and types and locations of welds using AWS Welding Symbols.



**PART 1 - GENERAL**

**1.8 WELDER'S QUALIFICATIONS**

- A. Welders must be qualified for Welds to be performed in accordance with AWS requirements.
- B. For each Welder, submit from approved Independent Laboratory or Inspection Service, Qualification Test Reports not older than 1 year.

**1.9 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.
- B. Store off ground with one end elevated for drainage. Do not bend.
- C. Underside of Decking will be exposed to view, therefore take every necessary precaution to protect Decking against damage or discoloration. Replace any damaged or unsightly Decking.

**1.10 REFERENCED SPECIFICATIONS**

- A. Conform to applicable requirements of Standard Deck Specifications published by Steel Deck Institute. Copies can be obtained from Institute at Box 25; Fox River Grove, IL 60021; (847) 458-4647.

**1.11 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**PART 2 - PRODUCTS**

**2.1 OFFICE AREA & CANOPY ROOF DECKING**

- A. Manufacturer: AEP Span. ASC Structural Deck, Nucor Vulcraft, United, Verco, Wheeling Corrugating, or approved.
- B. Type, Depth, & Minimum Metal Thickness before Galvanizing: See Drawings
- C. Manufacturing Standard: ASTM A-653
- D. Finish: Galvanized
- E. Minimum Coating Designation: G-90

(Cont.)

**PART 2 - PRODUCTS**

**2.1 OFFICE AREA & CANOPY ROOF DECKING (Cont.)**

- F. Required Accessories:
1. Vulcanized, closed-cell, synthetic-rubber Closure Devices to fill Openings between Decking and any adjacent Walls or Beams, or any exposed Cell Ends.
  2. Others necessary for complete installation.

**2.2 GALVANIZE REPAIR PAINT**

- A. Type: Zinc-rich
- B. Manufacturing Standard: ASTM A-780
- C. Minimum Zinc Content: 65%
- D. Minimum Coating Thickness: Match thickness on adjacent Member.

**2.3 FABRICATION**

- A. Except where Framing does not permit, form Decking in lengths to span 3 or more Supports. At Decking less than 2 spans long, shore Decking at mid-span.
- B. Butt End Laps and nest Side Laps.
- C. Decking will be exposed to view, therefore take every necessary precaution to protect Decking against damage or discoloration. Replace any damaged or unsightly Decking.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Structure and Surfaces to receive Decking and Accessories are accurately sized and located, clean, dry, rigid, secure, plumb, true, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.
- B. Do not overload Building Structure with stored Materials.

### **PART 3 - EXECUTION**

#### **3.3 INSTALLATION**

**A. General:**

1. Follow Referenced Specifications, Manufacturer's instructions, and approved Erection Drawings.
2. Decking will be exposed to view, therefore take every necessary precaution to protect Decking against damage or discoloration. Replace any damaged or unsightly Decking.
3. Accurately position Decking Ends with 3 inch minimum bearing on Support.
4. Align Decking before fastening permanently.
5. End Laps:
  - a. At Deck Ends: Extend Decking 2 inches beyond Support centerline
  - b. Elsewhere: Overlap end-joints 4 inches
6. Unless otherwise shown on Drawings, stagger End Joints.
7. Do not stretch or compress Side Lap interlocks.
8. Secure Decking flat and square to Support without warp or deflection.
9. Where necessary to prevent excessive Decking deflection, install Temporary Shoring. Maintain Shoring until Decking is capable of supporting itself and any applied loads without excessive deflection.

**B. Fastening:**

1. Immediately after Decking alignment, fasten Decking to Supports.
2. See Drawings for Fastening Requirements.
3. Weld in accordance with AWS Standards.
4. At 20 ga. and thinner Decking, if any, make Welds through 1/8 inch minimum thickness Welding Washers.
5. Weld Metal shall penetrate all Decking layers at Laps, and shall fuse to Supporting Members.

**C. Cutting & Fitting:**

1. Perform neat, square, trim, and true. Do not cut with Torch where Cut is exposed to final view.
2. Openings 6 inches and larger in any direction, if any:
  - a. Shop fabricate, and reinforce to support Load Capacity.
3. Opening less than 6 inches in largest dimension, if any:
  - a. Made by Trade requiring Opening.

**D. Closure Strips:**

1. Secure to Decking at any exposed Decking Ends or Edges, and at any voids between Decking and other Construction.

#### **3.4 ALLOWABLE INSTALLATION TOLERANCES**

- A.** Maximum Decking Alignment Variations: 1/4 inch in 40 ft.
- B.** Maximum Concavity or Convexity across any 3 adjacent Top Flanges: 1/16 inch

**PART 3 - EXECUTION**

**3.5 TOUCH UP**

- A. Wire brush, clean, and paint Welds, Burned and Damaged Areas, and Rust Spots.
- B. Touch up damaged Galvanized Surfaces with Galvanized Repair Paint. Match Coating thickness, and apply in accordance with ASTM A-780.
- C. Touch up damaged Paint Surfaces with matching Paint. Apply in accordance with Paint Manufacturer's instructions.

**3.6 PRODUCT CLEANING & REPAIRING**

- A. Remove any loose Rust, heavy Mill Scale, Oil, Dirt, or other Bond-reducing Substances from Decking scheduled to receive Finish Painting.
- B. 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.
- C. Remove Debris from Project Site upon Work completion, or sooner if directed.

**3.7 WASTE MANAGEMENT**

- A. Collect Scrap, Shipping Pallets, & Packaging Waste; and place where directed for recycling.

**3.8 PROTECTING COMPLETED WORK**

- A. Do not use Decking for Storage or Working Platforms until permanently secured in position.
- B. Advise General Contractor about maximum Construction Load Capacities of installed Decking.

**END OF SECTION**

**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 EXTENT OF WORK**

- A. Structural Steel Subcontractor:
  - 1. Provide all Steel Work indicated even if also shown on Architectural Drawings, except where specifically noted to be provided by other Trades.
- B. Miscellaneous Fabricated Steel Subcontractor:
  - 1. Except for Related Work Items specified below, provide all other Steel Work.

**1.3 PRODUCTS FURNISHED, BUT INSTALLED UNDER OTHER SECTIONS**

- A. Anchor Bolts installed under Section 03-10-00.

**1.4 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Chain Link Fencing: Section 02-82-00
- B. Reinforcing Steel for Concrete: Section 03-20-00
- C. Structural Steel: Section 05-10-00
- D. Steel Decking: Section 05-30-00
- E. Steel Hardware for Rough Carpentry: Section 06-10-00
- F. Steel Supports for Suspended Gypsum Board Ceilings: Section 09-10-00
- G. Steel Supports for Suspended Acoustic System Ceilings: Section 09-50-00
- H. Field Painting of Steel Items: Section 09-90-00
- I. Plastic Sleeve Cover for Pipe Bollards: Section 10-99-00

**1.5 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

(Cont.)

**PART 1 - GENERAL**

**1.6 ABBREVIATIONS**

- A. **AISC:** American Institute of Steel Construction; One East Wacker Dr.; Suite 700; Chicago, IL 60601-1802; (866) 275-2472.
- B. **ANSI:** American National Standards Institute; 1819 L St. NW; 6<sup>th</sup> Floor; Washington DC 20036; (202) 293-8020.
- C. **ASTM:** American Society for Testing and Materials; 100 Barr Harbor Dr.; West Conshohocken, PA 19428; (610) 832-9585

**1.7 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.8 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show locations, critical dimensions, required clearances, construction details, installation methods including any splices, attachments, and anchors.

**1.9 PRODUCT DELIVERY**

- A. Include all required Bolts and other Fastening Devices.

**1.10 PRODUCT STORAGE & HANDLING**

- A. Store Fabricated Steel above ground on Platforms, Skids, or other approved Supports.
- B. Store any Hot-dip Galvanized Steel Items with air-space between adjacent Items.
- C. Store other Materials in weather-tight and dry locations.
- D. Store packaged Materials in original unbroken Containers.
- E. Protect against damage and discoloration.

**1.11 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**PART 2 - PRODUCTS**

**2.1 STEEL SHAPES, BARS, & PLATES**

- A. Manufacturing Standard: ASTM A-36 or A-572
- B. Minimum Yield Strength: 36 ksi

**2.2 THREADED FASTENERS**

- A. Manufacturing Standard:
  - 1. Bolts & Nuts: ASTM A 307, Grade A
  - 2. Washers: ANSI Standard B 27
- B. Size & Spacing: See Drawings
- C. Finish: Manufacturer's standard

**2.3 ANCHOR BOLTS**

- A. Manufacturing Standard ASTM F-1554
- B. Grade: 36
- C. Size: See Drawings

**2.4 SHOP PAINT**

- A. Rust-Inhibiting Primer specified in Section 09-90-00.

**2.5 FABRICATION**

- A. General:
  - 1. Punch and shear to leave clean Surfaces.
  - 2. Weld permanent Connections; grind exposed Welds smooth.
  - 3. Provide Holes and Connections for Work of other Trades.
  - 4. Cut abutting Members to fit with full bearing contact.
  - 5. Form Elbows and Bends to uniform radii, free from buckles and twists, and with finished Surfaces smooth.
  - 6. Miter and cope Member intersections within 2°, fit to within 0.02 inches, and weld all around.
  - 7. Where exposed to weather, form to exclude water; allow for expansion and contraction.
  - 8. Do not use Screws or Bolts when they can be avoided; when used countersink Heads, draw up tight, and nick Threads to prevent loosening.

(Cont.)

**PART 2 - PRODUCTS**

**2.5 FABRICATION (Cont.)**

- B. Steel Ladder:
  - 1. Fabricate accurately; weld Joints, and grind Joints smooth.
  - 2. Vertical Members: 3/8 x 2 inch Steel, spaced 18 inches apart and at least 7 inches clear of Wall.
  - 3. Rungs: 3/4 inch round solid Steel Bars spaced 12 inches apart, unless otherwise shown on Drawings.
  - 4. Mortise Rungs into vertical Members, and weld securely.
- C. Operable Partition Headers:
  - 1. Fabricate as shown on Drawings.
  - 2. Support with regularly spaced Steel Rods secured to Overhead Structure.
- D. Pipe Bollards:
  - 1. Unless otherwise shown on Drawings, fabricate of 4 inch diameter Steel Pipe.

**2.6 FABRICATION TOLERANCES**

- A. Maximum deviation of individual Members from dimensions shown on Drawings as follows:
  - 1. Overall length of Members with both ends finished for compact bearing: 1/32 inch
  - 2. Overall length of Members without finished ends:
    - a. For Members up to 30 ft. long: 1/16 inch
    - b. For Members over 30 ft. long: 1/8 inch
- B. Twists, Bends, & Kinks: Unacceptable

**2.7 SHOP TREATMENT**

- A. Surface Preparation:
  - 1. Remove Grease, Oil, Dirt, loose Rust, loose Mill Scale, and any other bond-reducing Materials.
- B. Within 8 hours of Surface Preparation, apply the following:
  - 1. Apply 1 coat Shop Paint.
  - 2. Minimum Dry Film Thickness: 1.0 mil
  - 3. Do not apply Shop Paint to the following:
    - a. Within 2 inches of Surfaces to be field welded
    - b. Surfaces to be encased in Concrete

(Cont.)



**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces and Structures to receive Fabricated Steel are accurately sized and located, square, plumb, true, rigid, secure, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. General:
  - 1. Follow approved Shop Drawings.
  - 2. Install to true lines, plumb and level, and as detailed or required for rigidity and permanence.
- B. Steel Ladder:
  - 1. Install plumb, to true lines; anchor securely to adjacent Construction.
- C. Operable Partition Headers:
  - 1. Set at elevation shown.
  - 2. Brace as required to prevent horizontal movements.
- D. Pipe Bollards:
  - 1. Bury lower section of Pipe at least 36 inches below adjacent Finish Surface.
  - 2. Set Pipe plumb into 18 inch minimum diameter Concrete Footing.
  - 3. Fill Pipe with Concrete Grout; slope Concrete Grout top for drainage and trowel smooth. Immediately remove any Concrete Grout residual exposed on Pipe Surface.

**3.4 TOUCH UP**

- A. Touch up damaged Paint Surfaces with matching Paint. Apply in accordance with Paint Manufacturer's instructions.

**3.5 WASTE MANAGEMENT**

- A. Collect Scrap, Shipping Pallets, & Packaging Waste; and place where directed for recycling.

**PART 3 - EXECUTION**

**3.6 PRODUCT CLEANING & REPAIRING**

- A. Remove loose Rust, heavy Mill Scale, Oil, Dirt, and other bond-reducing Foreign Substances from Members scheduled to receive Finish Painting, or other direct-to-steel Coatings.
- B. Leave Surfaces ready for finishing specified in other Sections.
- C. 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.
- D. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Temporary Toilets, Field Office Buildings, Temporary Enclosures, Barricades, & Temporary Project Sign: Section 01-50-00
- B. Concrete Formwork: Section 03-10-00
- C. Custom-built Casework: Section 06-41-00
- D. Wood Paneling: Section 06-42-00
- E. Air Barrier System: Section 07-25-00
- F. Steel Wall-framing & Ceiling-framing: Section 09-10-00

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 EVIDENCE OF GRADE**

- A. Grademark of Association having jurisdiction must appear on each piece of Material as follows:
  - 1. Lumber: (WWPA) Western Wood Products Assn. or other Agency certified by Board of Review of American Lumber Standards Committee.
  - 2. Plywood: (APA) Engineered Wood Assn. (formally known as American Plywood Assn.); 7011 S. 19<sup>th</sup> St.; Tacoma, WA 98466; (253) 565-6600.

**1.6 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.
- B. Do not store Wood materials in wet or damp areas, or in contact with Ground.

**PART 2 - PRODUCTS**

**2.1 FASTENERS**

- A. Manufacturing Standard:
  - 1. Bolts: Fed. Spec. FF-B-575
  - 2. Nuts: Fed. Spec. FF-N-836
  - 3. Expansion Shields: Fed. Spec. FF-S-325
  - 4. Lag Screw & Lag Bolts: Fed. Spec. FF-B-561
  - 5. Toggle Bolts: Fed. Spec. FF-B-588
  - 6. Wood Screws: Fed. Spec. FF-S-111
  - 7. Nails & Staples: Fed. Spec. FF-N-105B
- B. Washers: Provide Washers under Bolt heads, Lag heads, and Nuts.
- C. Material: Steel
- D. Finish:
  - 1. At Preservative or Fire-retardant treated Wood: Stainless Steel
  - 2. At Other Exterior Work: Hot-dip Galvanized
  - 3. At Interior Work: Contractor's choice
- E. Type:
  - 1. Where type is specifically noted: Use type specified.
  - 2. Elsewhere:
    - a. Where applied to Lumber: Nails or Wood Screws
    - b. Where applied to Plywood or Particle Board: Nails or Wood Screws
    - c. Where applied to Metal: Machine Screws or Bolts
- F. Length: If and where underside of any Sheathing is exposed to view, provide short Fasteners that will not be visible.
- G. Extent of Work: Provide all necessary for installation of Work specified herein.

**2.2 GYPSUM WALL SHEATHING**

- A. Manufacturer & Brand: G-P DensGlass Gold Exterior Guard, National Gypsum Gold Bond e2XP, USG Securock Glass-Mat, or approved.
- B. Type: Paperless and Mold-resistant
- C. Manufacturing Standard: ASTM C-1177 - Type X
- D. Thickness: 5/8 inch
- E. Extent of Work: Provide over Office Area exterior Wall Studs, unless otherwise shown on Drawings.

(Cont.)

**PART 2 - PRODUCTS**

**2.3 WOOD BUMPERS**

- A. Material: Framing Lumber
- B. WWPA Grade: Construction
- C. Size: See Drawings
- D. Surface: Smooth
- E. Edges & Corners: Chamfer 1/2 inch
- F. Extent of Work: Provide on interior face of Trash Room Walls.

**2.4 TELEPHONE, MECHANICAL, & ELECTRICAL EQUIPMENT MOUNTING PANELS**

- A. Material: Fire-retardant-treated Plywood
- B. APA Grade: A
- C. Face Size: See Drawings
- D. Minimum Thickness: 1/2 inch
- E. Surface: Smooth
- F. Extent of Work: See Drawings

**2.5 EQUIPMENT CURBING**

- A. Material: Framing Lumber
- B. Surface Finish: Smooth
- C. Special Treatment: Pressure-preservative as specified in Section 06-31-00
- D. Size & Shape: See Drawings

**2.6 CANOPY SOFFIT VENTS**

- A. Manufacturer & Brand: \_\_\_\_\_, or approved.
- B. Material: Aluminum Sheetmetal
- C. Type: Perforated Grille
- D. Factory Finish: Prime-coated for field-painting specified in Section 09-90-00
- E. Extent of Work: Provide where shown on Drawings.

(Cont.)

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces to receive Work specified herein are rigid, secure, accurately sized and located, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION - GENERAL**

- A. Install Proprietary Products in accordance with Manufacturer's instructions.
- B. Use additional Fasteners to those specified herein where necessary to insure rigidity and permanence.
- C. Provide Washers under Nuts and Heads when making Bolted or Lag Screwed connections.
- D. Accurately locate, cut, fit, and install Work secure, rigid, to true lines, plumb, and level, unless otherwise indicated.

**3.4 GYPSUM WALL SHEATHING INSTALLATION**

- A. Install horizontally and continuous over 2 or more Supports, with End Joints on Supports and staggered.
- B. Secure with Screws recommended by Stud Manufacturer, spaced 4 inches o.c. at each Stud.

**3.5 SOFFIT VENT INSTALLATION**

- A. Install with non-corrosive Fasteners in accordance with Manufacturer's instructions.

**3.6 WOOD BUMPER INSTALLATION**

- A. Install horizontal with Joints over Supports.
- B. Secure with countersunk Hot-dip Galvanized Steel Bolts, Nuts, and Washers.

**PART 3 - EXECUTION**

**3.7 EQUIPMENT MOUNTING PANELS INSTALLATION**

- A. Secure with countersunk Screws at Panel Corners and at 12 inches o.c. maximum between.
- B. Verify and comply with Equipment Subcontractors' requirements.

**3.8 EQUIPMENT MOUNTING CURBS INSTALLATION**

- A. Securely attach to Roof Deck straight, plumb, and true.

**3.9 WASTE MANAGEMENT**

- A. Collect Scrap, Shipping Pallets, & Packaging Waste; and place where directed for recycling.

**3.10 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Rough Carpentry to be treated: Section 06-10-00
- B. Fire-retardant Treatment of Wood: Section 06-32-00

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 REFERENCED SPECIFICATIONS**

- A. Pressure Treatments specified hereunder refer to Specifications of American Wood Preservers Assn., hereinafter referred to as AWPB; Box 361784; Birmingham, AL 35236-1784; (250) 733-4077.
- B. Specifications can be obtained from Association.

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.6 CERTIFICATION**

- A. Affix Quality Seal of American Wood Preservers Bureau (AWPB) to each treated Member or, submit Affidavit stating that Preservative Treatment complies with these Specifications.
- B. Indicate year of treatment, Preservative used in treatment, applicable AWPB Quality Standard, trademark of AWPB Certified Agency, proper exposure conditions, Treating Company and Plant location, and Moisture condition of treated material.

**1.7 REGULATORY AGENCY REQUIREMENTS**

- A. Comply with Environmental Protection Agency requirements including the following:
  - 1. Wear Dust Masks and Eye Goggles when sawing or machining Treated Wood.
  - 2. Wash Hands after working with Treated Wood.
  - 3. Do not burn Treated Wood; dispose in normal Trash Collector.



**PART 1 - GENERAL**

**1.8 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage.

**PART 2 - PRODUCTS**

**2.1 PRESSURE-APPLIED TREATMENT MATERIAL**

- A. Treatment: AWPAC-2
- B. Preservative:
  - 1. Manufacturer & Brand: CSI ACQ Preserve, Osmose Nature Wood, Wolmanize Natural Select, or approved.
  - 2. Material: Alkaline Copper Quat or Copper Azole (ACQ)
- C. Extent of Work: Except at Flame-spread Treated Wood specified in Section 06-32-00, apply to Wood in the following locations:
  - 1. In contact with Earth
  - 2. In contact with Concrete
  - 3. In contact with Roofing
  - 4. In contact with exterior Sheetmetal
  - 5. Elsewhere shown on Drawings or in Specifications

**2.2 BRUSH-APPLIED TREATMENT MATERIAL**

- A. Material: 2% minimum Copper Naphthenate Solution, or approved.
- B. Extent of Work: Treat any Field Cuts to Pressure-treated Material

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Material to receive Treatment does not exceed Moisture Content specified for similar Untreated Wood.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**PART 3 - EXECUTION**

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 PRESSURE TREATMENT**

- A. Follow Referenced Specifications and Treatment Manufacturer's instructions.
- B. Incise Members prior to Treatment.
- C. Minimum Retention:
  - 1. If and where in contact with Ground or Water: 0.40 pcf
  - 2. Where above Ground: 0.25 pcf

**3.4 FIELD CUTS**

- A. In accordance with Treatment Manufacturer's instructions, liberally apply 2 coats of Brush-applied Treatment Material to field-cut Surfaces.

**3.5 WASTE DISPOSAL**

- A. Do not burn Treated Wood Scraps.
- B. Do not mix Treated Wood Scraps with Untreated Wood. Separate Scraps and lawfully dispose.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Preservative Treatment of Wood: Section 06-31-00
- B. Wood Paneling to be Fire-resistant treated: Section 06-42-00

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 REFERENCED SPECIFICATIONS**

- A. Pressure Treatments specified hereunder refer to Specifications of American Wood Preservers Assn., Box 361784; Birmingham, AL 35236-1784; (250) 733-4077.
- B. Specifications can be obtained from Association.

**1.5 REGULATORY AGENCY REQUIREMENTS**

- A. Maximum Flame Spread Rating: 25, maintained during 30 minute Test.
- B. Comply with Environmental Protection Agency requirements including the following:
  - 1. Wear Dust Masks and Eye Goggles when sawing or machining Treated Wood.
  - 2. Wash Hands after working with Treated Wood.
  - 3. Do not burn Treated Wood; dispose in normal Trash Collector.

**1.6 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.7 LABELS**

- A. Affix U.L. Label or Stamp to each Treated Piece stating that Treatment complies with these Specifications.

**PART 1 - GENERAL**

**1.8 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage.
- B. Store Treated Material indoor and in dry location.

**PART 2 - PRODUCTS**

**2.1 TREATMENT MATERIALS**

- A. Manufacturer & Brand: Baxter Flamescape, Hickson Dricon, or approved.
- B. Chemicals:
  - 1. Type: Approved for use as Wood Preservative by U.S. Environmental Protection Agency
  - 2. Prohibited Components: Ammonium Phosphate, Formaldehyde, Halogens, & Sulfates.
- C. Maximum MIL-L-19140E Corrosion Rates of Metal in Contact with Treated Wood: 1 mil per year

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Material to receive Treatment does not exceed Moisture Content specified for similar Untreated Wood.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 TREATMENT**

- A. Conform to Referenced Specifications and Underwriters Laboratories FR-S requirements.
- B. Where Plywood is scheduled for natural finish do not treat Face Veneers.

**PART 3 - EXECUTION**

**3.4 MAXIMUM MOISTURE CONTENT AFTER TREATMENT**

- A. Testing Method: ASTM D-3201
- B. Environmental Conditions during Tests:
  - 1. Maximum Relative Humidity: 95%
  - 2. Maximum Air Temperature: 80° F
  - 3. Maximum Moisture Content: 12%

**3.5 FIELD CUTTING AFTER TREATMENT**

- A. Do not rip, resurface, or mill Material.
- B. Only end-trimming and hole-drilling are permitted.

**3.6 CLEANING**

- A. After Architect's inspection remove Labels from Members exposed to view.

**3.7 WASTE DISPOSAL**

- A. Do not burn Treated Wood Scraps.
- B. Do not mix Treated Wood Scraps with Untreated Wood. Separate Scraps and lawfully dispose.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Solid Surface Countertops: Section 06-65-00
- B. Field Painting & Finishing: Section 09-90-00
- C. Sinks & Fittings built into Casework, including plumbing connections: See Plumbing Specifications
- D. Electrical Outlets & Conduit built into Casework, including electrical connections: See Electrical Specifications

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 REFERENCED STANDARDS**

- A. Except as herein modified, Material and Workmanship Grades shall be as defined in North American Architectural Woodwork Standards (NAAWS) 3.1 published by Woodwork Institute (WI); Box 980247; West Sacramento, CA 95798-0247; (916) 372-9943.
- B. Standards may be obtained from Institute.

**1.5 DEFINITIONS**

- A. Exposed Surfaces:
  - 1. Surfaces visible when Drawers and Doors are closed, including any Open Shelving
  - 2. Cabinet bottoms, if any, 42 inches or more above Floor.
  - 3. Cabinet tops, if any, less than 72 inches above Floor.
- B. Semi-exposed Surfaces:
  - 1. Surfaces which become visible after Drawers and Doors are opened, including backs of Doors.
  - 2. Cabinet bottoms, if any, more than 30 inches but less than 42 inches above Floor.
  - 3. Cabinet tops, if any, between 72 and 78 inches above Floor.
- C. Concealed Surfaces:
  - 1. Surfaces not normally visible after installation.
  - 2. Cabinet bottoms, if any, less than 30 inches above Floor.
  - 3. Cabinet tops, if any, 78 inches or more above Floor.
  - 4. Web Frames, Dust Panels, Stretchers, Blocking, and Backs behind Drawers.

**PART 1 - GENERAL**

**1.6 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.7 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show locations, arrangements, shapes, dimensions, joint details, and other pertinent items.
- C. Show connections to adjacent Work, and complete assembly, whether or not Materials are furnished by Mill.
- D. Include Manufacturer's descriptive literature for Specialty Items.
- E. Identify Material Grades, Workmanship Grades, Wood Species, and Finishes.

**1.8 SAMPLES**

- A. In accordance with Section 01-33-00, submit for review and acceptance 2 samples of each color of Plastic Laminate proposed for use.

**1.9 PRODUCT DELIVERY**

- A. Do not deliver Products to Jobsite until notified by General Contractor that Project is conditioned and prepared to handle and store Products without damage or discoloration.

**1.10 PRODUCT STORAGE & HANDLING**

- A. Protect against damage and discoloration.

**1.11 TEMPERATURE & HUMIDITY**

- A. Where Casework or Shelving are located, maintain the following:
  - 1. Minimum Ambient Air Temperature: 55°F
  - 2. Relative Humidity: 25% to 55%

**1.12 ILLUMINATION**

- A. Perform no work under less than 30 ft. candles of light measured 3 ft. above Floor.

**PART 1 - GENERAL**

**1.13 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**PART 2 - PRODUCTS**

**2.1 LUMBER**

- A. Species: Douglas Fir
- B. Grain: Vertical

**2.2 PLYWOOD**

- A. Manufacturing Standard: U.S. Product Standard PS-1
- B. Types:
  - 1. Where Exposed to Moisture: Exposure 1
  - 2. Elsewhere: Exposure 2
- C. Core: Veneer
- D. Face Veneer:
  - 1. Species: Douglas Fir
  - 2. Cut: Rotary

**2.3 PARTICLE BOARD**

- A. Manufacturer & Brand: Weyerhaeuser Timblend, Champion Novaply, Willamette Industries Duraflake, or approved.
- B. Manufacturing Standard: ANSI A208.1 grade M-5
- C. Minimum Density: 45 pcf
- D. Maximum Moisture Content: 8%
- E. Formaldehyde: None added

**2.4 CASEWORK INTERIOR LINER**

- A. Material: Melamine Low Pressure Laminate
- B. Type: Thermal-pressed
- C. Color: White
- D. Extent of Work: Cover Semi-exposed Casework and Shelving Surfaces.



**PART 2 - PRODUCTS**

**2.5 PLASTIC LAMINATE FACING**

- A. Material: High pressure type conforming to NEMA LD-1
- B. Thickness:
  - 1. At exposed Surfaces including Door & Drawer Fronts and Backs: 0.028 inch
  - 2. At Semi-exposed Surfaces: 0.020 inch
- C. Color & Pattern: See Color Schedule on Drawings.

**2.6 EDGE BANDING**

- A. Material: Polyvinyl Chloride (PVC)
- B. Nominal Thickness: 0.020 inches
- C. Color: Match adjacent Facing Material.

**2.7 FINISH HARDWARE**

- A. Case-mounted Adjustable Shelf Supports:
  - 1. Manufacturer & Model: Knape & Vogt #346 with #129 Rubber Cushion, or approved.
  - 2. Type: Dowel
  - 3. Material: Steel
  - 4. Finish: Anochrome
- B. Extension Drawer Slides:
  - 1. Manufacturer & Model: Contractor's choice
  - 2. Minimum Storage Load Capacity:
    - a. At Drawers less than 8 inches high: 75 lbs.
    - b. At Drawers 8 inches and higher: 150 lbs.
  - 3. Type: Soft-closing full-extension
  - 4. Extent of Work: Provide on all Drawers.
- C. Extension Computer Keyboard & Mouse Tray:
  - 1. Manufacturer & Model: Knape & Vogt 5710, or approved.
  - 2. Extent of Work: See Drawings
- D. Door Hinges:
  - 1. Manufacturer: Blum, or approved.
  - 2. Type: Concealed, soft-closing, and satisfying conditions of use.
  - 3. Opening Angle: 125°
  - 4. Finish: Nickel plated
- E. Drawer & Door Pulls:
  - 1. Manufacturer: \_\_\_\_\_, or approved.
  - 2. Model: \_\_\_\_\_
  - 3. Finish: Match adjacent Door Hardware specified in Section 08-71-00.

(Cont.)

**PART 2 - PRODUCTS**

**2.7 FINISH HARDWARE (Cont.)**

- F. Cable Grommets:
  - 1. Manufacturer: Doug Mockett (800) 523-1269, or approved.
  - 2. Series: TG Flip Top
  - 3. Nominal Diameter: 2 inches
  - 4. Material: Plastic
  - 5. Color: Match adjacent Countertop as close as possible.
  - 6. Extent of Work: See Drawings
- G. Drawer & Door Locks:
  - 1. Manufacturer: Schlage, or approved.
  - 2. Series:
    - a. At Doors: CL1000
    - b. At Drawers: CL2000
  - 3. Barrel Length: Satisfy conditions of use.
  - 4. Keying:
    - a. Key Locks in different Rooms separately.
    - b. Key Locks within each Room alike and master-key to match Room Entry Door Lock, if any.
  - 5. Finish: Match adjacent Door Hardware specified in Section 08-71-00
  - 6. Extent of Work: Provide where shown on Drawings.

**2.8 FABRICATION**

- A. General:
  - 1. NAAWS Fabrication Style: Flush Overlay
  - 2. NAAWS Fabrication Grade: Custom
  - 3. All Shelves adjustable, unless otherwise shown on Drawings.
  - 4. Verify dimensions of Sinks and other Items to be built into Cases and Counters.
  - 5. Assemble in Fabrication Shop where feasible.
  - 6. Prior to fabrication, obtain Architect's approval of field-splice locations.
  - 7. Fabricate exposed Joints tight and flush.
  - 8. Fabricate any Curves in longest practicable segments by laminating and/or machining. Do not use "Chord Segments".
  - 9. Assemble Cases with Adhesive. Use Screws and Bolts where required for strength and rigidity. Conceal Fastenings wherever possible. Where not possible, neatly countersink Exposed Fastener and fill Surface with Material matching adjacent Surface.
  - 10. Install Finish Hardware in Fabrication Shop.

(Cont.)

**PART 2 - PRODUCTS**

**2.8 FABRICATION (Cont.)**

- B. Materials, unless elsewhere specifically noted otherwise:
  - 1. Exposed Surfaces: Plastic Laminate faced
  - 2. Semi-exposed Surfaces:
    - a. Backside of Doors & Drawer Fronts: Match adjacent exposed Surfaces
    - b. Door & Drawer Face Edges: Edge Banding
    - c. Elsewhere: Casework Interior Liner
  - 3. Shelving & Countertops:
    - a. Material: Plywood
    - b. Thickness:
      - 1. At Spans up to 36 inches: 3/4 inch
      - 2. At Spans between 36 and 48 inches: 1 inch
  - 4. Concealed Casework Backs: 1/4 inch thick Cabinet Interior Liner faced toward Case Interior
  - 5. Drawer Bottoms: 1/4 inch thick Cabinet Interior Liner faced upward
  - 6. All Other Construction Materials: 3/4 inch thick Particle Board
- C. Edge Banding, including Door & Drawer Face Edges:
  - 1. At Plastic Laminate Faced Surfaces: Cover with PVC Edge Banding
  - 2. At Shelving & other Semi-concealed Surfaces: Band with matching Interior Casework Liner in accordance with NAAWS Standards.
- D. Adjustable Shelf Hardware:
  - 1. Drill Holes in Case Wall to receive Shelf Support Dowels. Space Holes 1 inch o.c. maximum over full height of Wall.
- E. Drawer Slides, Computer Keyboard Trays, Locks, Grommets, & Pulls:
  - 1. Follow Manufacturer's instructions.
- F. At Sink Cabinets:
  - 1. Hold Bottom Shelf 1/2 inch back from rear face of Door to provide open space for ventilation.
- G. Door Silencers:
  - 1. Provide Felt or Rubber Silencers where necessary to prevent noisy Door-to-Frame contact.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces to receive Casework or Shelving are straight, plumb, true, solid, rigid, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**PART 3 - EXECUTION**

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. Miter Corners, and bevel-cut and glue Joints.
- B. At adjacent in-line Base Cabinets where Rubber Base is scheduled, provide continuous Wood Backing to receive Rubber Base.
- C. Secure Work in place, plumb, square, true, level, and without distortion; level where necessary with concealed Shims.
- D. Secure Work to Backing with countersunk Screws.
- E. Accurately scribe Face Plates, Filler Strips, and Trim Strips to adjacent surface irregularities. Install with Finish Nails, set for puttying, except where Screws are required.
- F. Ease sharp External Corners prior to finishing.

**3.4 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.5 WASTE MANAGEMENT**

- A. Collect Scrap, Shipping Pallets, & Packaging Waste; and place where directed for recycling.

**3.6 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 WORK INCLUDED BUT SPECIFIED IN OTHER SECTION**

- A. Fire Retardant Treatment for Paneling: Section 06-32-00

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Rough Carpentry: Section 06-10-00

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 REFERENCED QUALITY STANDARDS**

- A. Unless otherwise specified herein, Standards shall be defined by the following:
- B. Material Quality Standards:
  - 1. APA Grading Rules of Engineered Wood Assn. (*formally known as American Plywood Assn.*); 7011 S. 19<sup>th</sup> St.; Tacoma, WA 9841; (253) 565-6600.
- C. Interior Paneling Workmanship Standards:
  - 1. North American Architectural Woodwork Standards (NAAWS) 3.1 published by Woodwork Institute (WI); Box 980247; West Sacramento, CA 95798; (916) 372-9943.
- D. Standards can be obtained from Standards Publisher.

**1.6 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.7 PRODUCT DELIVERY**

- A. Do not deliver Products to Jobsite until notified by General Contractor that Project is conditioned and prepared to handle and store Products without damage or discoloration.

**PART 1 - GENERAL**

**1.8 PRODUCT STORAGE & HANDLING**

- A. Protect against damage and discoloration.

**1.9 ILLUMINATION**

- A. Perform no Work under less than 30 ft. candles of light measured 3 ft. above adjacent Floor Surface.

**1.10 TEMPERATURE**

- A. Maintain 50°F minimum in interior spaces where Materials are located.

**PART 2 - PRODUCTS**

**2.1 PLYWOOD PANELING**

- A. Species: Douglas Fir
- B. Face Veneer:
  - 1. Cut: Plain sliced
  - 2. Grade: APA 303 0/C (Clear)
  - 3. Face Texture: Smooth
- C. Thickness: 5/8 inches
- D. Special Treatment: Treat Paneling with Flame Retardant as specified in Section 06-32-00.

**2.2 FASTENERS**

- A. Material: Stainless Steel
- B. Head Shape: Oval
- C. Type: Countersunk
- D. Size & Quantity: As required to secure Members in position

(Cont.)

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Structure and Surfaces to receive Paneling are straight, plumb, true, solid, rigid, dry, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. NAAWS Workmanship Grade: Premium
- B. Securely install straight, plumb, level, parallel, and true as appropriate.
- C. Fit neatly at Joints and against Trim.
- D. Accurately scribe to any adjacent Surface irregularities.
- E. Locate Joints over solid bearing.
- F. Remove sharp External Corners.
- G. Fit accurately and neatly around any Projections through Paneling.
- H. Install with 1/16 inch gap between adjacent Panels.
- I. Secure with Screws spaced 6 inches apart along Panel Edges and 12 inches apart along Intermediate Supports.

**3.4 WASTE MANAGEMENT**

- A. Collect Scrap, Shipping Pallets, & Packaging Waste; and place where directed for recycling.

**3.5 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Gypsum Board Walls to receive Panels: Section 09-25-00

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 MAINTENANCE INSTRUCTIONS**

- A. In accordance with Section 01-83-00, submit Instructions to General Contractor for inclusion in Owner's Maintenance Manual.

**1.6 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Deliver in unbroken Packages with Manufacturer's legible Label thereon. Do not remove Labels or open Packages until Architect inspects and approves.
- B. Store in clean and dry Storage Area.
- C. Protect against damage and discoloration.
- D. 24 hours prior to application, remove Panels from package and allow Panels to acclimatize with Installation Area Temperature and Humidity.

(Cont.)



**PART 2 - PRODUCTS**

**2.1 PANELS**

- A. Manufacturer: Crane Composites [formally Kemlite] (800) 435-0080, Panolam Industries FRP (866) 925-4377, or approved.
- B. Brand: Similar to Crane Varietex
- C. Material: Fiberglass-reinforced Plastic (FRP)
- D. ASTM E-84 Fire Rating Class: A
- E. Surface Texture: Smooth
- F. Color: See Color Schedule on Drawings.

**2.2 TRIM**

- A. Type: Recommended by Panel Manufacturer for conditions of use
- B. Color: Match adjacent Panels.
- C. Extent of Work: Provide at Panel edges.

**2.3 PRIMERS & ADHESIVES**

- A. Manufacturer & Brand: Contractor's choice
- B. Type: Mildew-resistant, satisfying conditions of use, and permitting removal of Panels without Substrate damage.
- C. Fire-resistiveness: No less than Panel rating.

**2.4 FASTENERS**

- A. Manufacturer: Contractor's choice
- B. Type: Concealed and satisfying conditions of use.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces to receive Panels are true, sound, clean, dust-free, mildew-free, free from conditions that could damage Panels or impair Adhesive bond, and be otherwise properly prepared.
- B. Verify that Surfaces to receive Panels do not exceed 4% Moisture content.
- C. Prior to starting Work, notify General Contractor about defects requiring correction.
- D. Do not start Work until conditions are satisfactory.

**PART 3 - EXECUTION**

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 PREPARATION WORK**

- A. Before applying Panels, remove any Finish Hardware, Electrical Cover Plates, Mechanical Grilles or Registers, etc. which interfere with Panel application.
- B. Carefully store Removed Items, and accurately replace following Panel application.

**3.4 SURFACE PREPARATION**

- A. Remove any Substrate Surface Defects that could show through Panel surface.

**3.5 PANEL INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Except at any Color or Pattern breaks, do not install Panels with Horizontal Seams.
- C. Do not extend Panels below top of any adjacent Wall Base.
- D. Take special care to assure complete adhesion at Joints, Edges, and Corners.

**3.6 TRIM INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Install any necessary Butt Joints tight, neat, hairline, and no closer than 4 ft. apart.

**3.7 WASTE MANAGEMENT**

- A. Collect Scrap, Shipping Pallets, & Packaging Waste; and place where directed for recycling.

**3.8 PRODUCT CLEANING & REPAIRING**

- A. Immediately remove any Adhesive from Adjacent Surfaces.
- B. Leave Surfaces clean and defect-free at time of Substantial Project Completion.
- C. 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.
- D. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Casework to receive Countertops: Section 06-41-00
- B. Gypsum Board to receive Backsplashes: Section 09-25-00

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show dimensions, shapes, fabrication details, connections to adjacent Work, and other pertinent items.

**1.6 SAMPLES**

- A. Prior to fabrication, submit in accordance with Section 01-33-00, two 2x2 inch (min.) Solid Surface color samples for Architect's approval.

**1.7 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.

(Cont.)

**PART 1 - GENERAL**

**1.8 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**1.9 SPECIAL WARRANTY**

- A. Warrant Work of this Section for 10 years against Material defects occurring under normal usage.
- B. Repair or, when directed, replace defective Countertops.

**PART 2 - PRODUCTS**

**2.1 COUNTERTOPS & BACKSPLASHES**

- A. Manufacturer & Brand: DuPont Corian, Wilsonart Gibraltar, or approved.
- B. Color: See Color Schedule on Drawings.
- C. Size, Shape, & Thickness: See Drawings

**2.2 ADHESIVE**

- A. Manufacturer & Brand: Contractor's choice
- B. Type: Satisfy conditions of use.

**2.3 JOINT SEALANT**

- A. Manufacturer: Dow, GE, or approved.
- B. Type: Silicone with Mildew-inhibiter
- C. Color: Clear translucent

(Cont.)

## **PART 2 - PRODUCTS**

### **2.4 FABRICATION**

- A. Fabricate to sizes and shapes shown on Drawings.
- B. Fabricate Sinks, if any, with rounded corners.
- C. Joints:
  - 1. Longitudinal Joints: None permitted
  - 2. Cross Joints: Locate no closer than 6 ft. apart and, where possible, at least 24 inches away from any Sink.
  - 3. Make Joints between adjacent Components inconspicuous and without voids, secure against movement with Adhesive, and reinforce with 2 inch minimum width Strip under each Joint.
- D. Backsplash Ends: Return along Wall to Counter front, unless otherwise shown on Drawings.
- E. Finishing:
  - 1. Ease exposed edges.
  - 2. Finish top and edge surfaces smooth and uniform.
  - 3. Polish exposed top and edge surfaces to Matte Finish with 5 to 20 Gloss Rating.

## **PART 3 - EXECUTION**

### **3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces to receive Countertops and Backsplashes are accurately sized and located, dry, clean, smooth, sound, secure, and are otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

### **3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by work of this Section.

### **3.3 INSTALLATION**

- A. Install Components level, square, plumb, and true in accordance with approved Shop Drawings and Manufacturer's instructions.
- B. Butt Backsplash to Countertop without Metal Trim.
- C. Secure Backsplash to Wall with Adhesive.
- D. Fill Joint between Countertop and Backsplash with Joint Sealant; strike-off Sealant flush with adjacent Surface.

**PART 3 - EXECUTION**

**3.4 PROTECTION**

- A. Protect completed Work against damage or discoloration.

**3.5 WASTE MANAGEMENT**

- A. Collect Scrap, Shipping Pallets, & Packaging Waste; and place where directed for recycling.

**3.6 PRODUCT CLEANING & REPAIRING**

- A. Promptly remove any excess Adhesive or Sealant.
- B. Remove any Stains from surfaces.
- C. 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.
- D. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Weather-Resistance Barrier System: Section 07-25-00
- B. Thermal Insulation installed as part of Single Ply Roofing: Section 07-53-00
- C. Mechanical Systems Thermal Insulation: See Plumbing & HVAC Specifications

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 DEFINITIONS**

- A. Any specified "R" values designate Thermal Resistance of Insulation only, not including Air Spaces or other factors assumed to result in higher "R" values.

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.6 REFERENCED SPECIFICATIONS**

- A. Install Products in compliance with the following:
  - 1. Air-infiltration Sealant: ASTM E-283.
- B. Fiber Batt Insulation: ASTM C-1320

**1.7 REGULATORY AGENCY REQUIREMENTS**

- A. If and where Insulation is not covered with Gypsum Board or other Fire-rated Material:
  - 1. Maximum Insulation & Facing Flame Spread: 25
  - 2. Maximum Insulation & Facing Smoke Density: 450

**PART 1 - GENERAL**

**1.8 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Deliver to Project Site in Manufacturer's original unopened packages.
- B. Label Package Wrappers with Brand Name, Insulation type, and Thermal Rating.
- C. Store Materials off ground.
- D. Protect against damage and discoloration.
- E. Weight Foam Insulation as required to prevent wind-induced damage.
- F. Protect Foam Insulation edges against crushing and breaking.
- G. Immediately remove damaged or wet Materials from Jobsite.

**1.9 ENVIRONMENTAL CONDITIONS**

- A. Do not install Insulation when Surface to receive Insulation is wet or when Surface and/or Ambient Air Temperatures are lower than Manufacturer's specified minimums.

**1.10 ADVANCE NOTICES**

- A. Notify Architect at least 24 hours prior to covering-over Work of this Section so inspection can be made.

**PART 2 - PRODUCTS**

**2.1 AIR-INFILTRATION SPRAY-FOAM SEALANT**

- A. Manufacturer & Brand: BASF SprayTite 178, or approved.
- B. Minimum ASTM E-96 Water Vapor Permeance:
  - 1. Dry Cup: 2 perms
  - 2. Wet Cup: 30 perm
- C. ASTM C-719 Durability over more than 10 cycles: No cohesive-failure or cracking
- D. Maximum ASTM E-84 Flame Spread: 25
- E. Maximum ASTM E-84 Smoke Developed: 450
- F. Maximum ASTM E-283 Leakage Rate at 1.57 psf: 0.01 cu. ft. per sq. ft.
- G. Extent of Work: Prior to installing adjacent Thermal Insulation, apply Sealant continuously and evenly where necessary to prevent Air-passage between Conditioned and Unconditioned Spaces.



**PART 2 - PRODUCTS**

**2.2 METAL BUILDING ROOF & EXTERIOR WALL INSULATION**

- A. Manufacturer: Owens Corning, or approved.
- B. Brand: EcoTouch
- C. Material: Formaldehyde-free Fibrous-Glass Blanket
- D. Minimum Recycled Material Content: 65%
- E. Minimum Post-consumer Material Content: 41%
- F. Minimum Thicknesses & Thermal Resistance Values (R): See Drawings
- G. Length: Full-length, single-piece where practicable
- H. Insulation Facing:
  - 1. Manufacturer: Owens Corning, or approved.
  - 2. Brand: OptiLiner Banded Liner System
  - 3. Type: 1070
  - 4. Thickness: 9 mils
  - 5. ASTM E-96 Moisture Vapor Transmission Rate: 0.02 perms
  - 6. Color: White
  - 7. ASTM E-84 Flame Spread Rating: 0
  - 8. ASTM E-84 Smoke Development Rating: 3

**2.3 VESTIBULE CEILING INSULATION**

- A. Manufacturer: Certainteed, Johns Manville, Knauf, Owens/Corning, US Gypsum, or approved.
- B. Material: Formaldehyde-free Glass Fiber
- C. Manufacturing Standard: ASTM C-665
- D. Type: Blanket or Batt
- E. Vapor Retarding Facing:
  - 1. Material: Kraft Paper
  - 2. Manufacturing Standard: ASTM C-665
  - 3. Maximum Permeability Rating: 1.0 perms
- F. Minimum Thermal Resistance Factor (R): 38

**2.4 OFFICE & COMPRESSOR SHED ROOF INSULATION**

- A. Manufacturer & Brand: Dow Thermax Sheathing, or approved.
- B. Insulating Material: Polyisocyanurate Foam
- C. Manufacturing Standard: ASTM C-1289, type II
- D. Blowing Agents: HCFC-free & HFC-free
- E. Ozone Depletion Potential (ODP): 0
- F. Global Warming Potential (GWP): Negligible
- G. Nominal ASTM D-1622 Density: 2 pcf
- H. Facing Material on both Faces: Aluminum Foil
- I. Thickness: 6 inches

**PART 2 - PRODUCTS**

**2.5 INSULATION SUPPORTS**

- A. Material: Plastic Mesh, Wire Devices, or approved.
- B. Size: Satisfy conditions of use
- C. Extent of Work: Provide where necessary to support Insulation against displacement.

**2.6 ADHESIVE**

- A. Type: Recommended by Manufacturer of Material to be secured.

**2.7 VAPOR PROOF TAPE**

- A. Manufacturer & Brand: Alumiseal Zero Perm (800) 235-2313, or approved.
- B. Material: Adhesive-backed, Mylar-faced Aluminum Foil.
- C. Color:
  - 1. If and where Exposed to View: Match adjacent Vapor Retarder
  - 2. Where Concealed: Contractor's choice
- D. Width: 1-1/2 inches
- E. Approximate Permeability Rating: 0.0 perms

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Work of preceding Trades is completed.
- B. Verify that Surfaces and Spaces to receive Insulation are accurately sized and located, dry, protected against inclement weather, clean, and otherwise properly prepared.
- C. Prior to starting Work, notify General Contractor about defects requiring correction.
- D. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.
- B. Maintain the following Minimum Clearances between Insulation and any recessed Lighting Fixtures, Metal Chimneys, Metal Gas Vents, or other similar Device, unless Device is UL-rated for Zero Clearance:
  - 1. Side Clearance: 3 inches
  - 2. Top Clearance: 24 inches

**PART 3 - EXECUTION**

**3.3 SURFACE PREPARATION**

- A. Remove, or protect against, Projections which could damage Insulation or prevent proper Insulation installation.

**3.4 INSULATION INSTALLATION, GENERAL**

- A. Follow Manufacturer's instructions and Referenced Specifications.
- B. Fit Insulation snugly between Framing without forcing.
- C. Where Doors, Windows, or other Openings occur in Framing, fill Voids with Insulation.
- D. Where adjacent pieces of Insulation abut, fit snugly together without overlapping.
- E. Permit no gaps for Air passage.
- F. Carefully cut and fit Insulation around Pipes, Conduits, and other Obstructions.
- G. Where Pipes, Conduit, and other Obstructions are located within Insulated Walls or within other Insulated Spaces, place Insulation between cold-in-winter Surface and Obstruction, compressing Insulation where necessary.
- H. Except where indicated above, do not compress Insulation more than 10%.

**3.5 AIR-INFILTRATION SPRAY-FOAM SEALANT INSTALLATION**

- A. Follow Manufacturer's instructions.

**3.6 MINERAL FIBER INSULATION INSTALLATION**

- A. Install Insulation with Vapor Retardant Facing on warm-in-winter side of Assembly.
- B. Use full-length, single-piece Batts wherever practicable.
- C. At Floors over Unheated Space install Insulation tight to underside of overhead Deck.
- D. Where necessary, provide Insulation Supports to prevent Insulation displacement or sagging.

**3.7 RIGID BOARD INSULATION INSTALLATION**

- A. Install horizontally, in regular courses, and true to line.
- B. Stagger adjacent Joints.
- C. Bring edges into moderate contact without deforming.
- D. Maintain sufficient Perimeter Edge Space for Insulation expansion.
- E. Cut to fit neatly at Corners and around Projections through Insulation.
- F. Secure Insulation to Substrate.
- G. Maintain Insulation integrity.

**PART 3 - EXECUTION**

**3.8 VAPOR RETARDER FACING TAPING & PATCHING**

- A. Apply Vapor Proof Tape over Joints between adjacent Batts and Lapped Flanges.
- B. Patch Facing punctures, penetrations, tears, and voids with Vapor Proof Tape.
- C. Permit no Openings for Vapor transmission.

**3.9 WASTE MANAGEMENT**

- A. Reuse any Insulation Scraps where Insulation is concealed from view.
- B. Collect and place Scraps, Pallets, and Packaging Waste where directed for recycling.

**3.10 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 WORK INCLUDED**

- A. System shall:
  - 1. Prevent Bulk Water from entering Exterior Walls
  - 2. Prevent Air-passage through Exterior Walls
- B. System shall bridge and seal the following Air or Water Leakage Pathways and Gaps:
  - 1. Connections of Exterior Walls to Roof
  - 2. Connections of Exterior Walls to Foundations
  - 3. Exterior Wall Openings and Penetrations
  - 4. Piping, Conduit, Duct, and Similar Penetrations
  - 5. Ties, Screws, Bolts, and similar Penetrations
  - 6. Any other Air or Water Leakage Pathways in Building Envelope

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Wall Sheathing to receive System: Section 06-10-00
- B. Thermal Insulation: Section 07-20-00
- C. Sheetmetal Flashing: Section 07-62-00
- D. Joints Sealants: Section 07-92-00

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.6 ADVANCE NOTICES**

- A. Notify Architect at least 48 hours before System will be covered-over so inspections can be made.

**PART 1 - GENERAL**

**1.7 PERFORMANCE REQUIREMENTS**

- A. Provide continuous Air Barrier and Water Drainage Plane flashed to discharge Condensation and Bulk Water to Building exterior.
- B. Prevent Air-passage through Exterior Walls.
- C. Permit Water Vapor transmission to enable drying of Building Interior Products.
- D. Provide necessary Expansion and Control Joints to prevent unacceptable Air Leakage at the following:
  - 1. Openings caused by Substrate movement
  - 2. Substrate Material changes
  - 3. Penetrations
  - 4. Tie-in Anchors
  - 5. Perimeter Transitions

**1.8 APPLICATOR'S QUALIFICATIONS**

- A. System Applicator must be employed by or acceptable to System Manufacturer.

**1.9 MANUFACTURER'S INSTRUCTIONS**

- A. Maintain 1 copy of Manufacturers' written Installation Instructions at Project Site.

**1.10 PRE-INSTALLATION CONFERENCE**

- A. Prior to commencing Work, conduct Conference in compliance with Section 01-31-50.
- B. Required Attendance:
  - 1. General Contractor
  - 2. System Materials Manufacturer
  - 3. System Applicator
  - 4. Other adjacent Work Applicators affecting or affected by System Work.

**1.11 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Follow Manufacturers' instructions.
- B. Deliver System Components to Project Site in Manufacturer's original unopened Packages. Label Package Wrappers with Manufacturer's Brand Name, and where appropriate, Material thickness and Perm Rating.
- C. Protect Products against damage.

(Cont.)

**PART 1 - GENERAL**

**1.11 PRODUCT DELIVERY, STORAGE, & HANDLING (Cont.)**

- D. Store Roll Materials on end, and in original packaging.
- E. Protect Products against direct sunlight and Inclement Weather until ready for use.
- F. Store Barrier Membranes, Adhesives, and Primers at 40°F minimum temperature.
- G. Keep Solvents away from open flame and excessive heat.

**1.12 MINIMUM WEATHER REQUIREMENTS**

- A. Do not perform Work during Rain or Inclement Weather, or upon Frost-covered or Wet-substrates.

**1.13 WARRANTY**

- A. Warrant Barrier System; including Membrane Materials, Sealants, and Flashings against failure for 10 years after Project Substantial Completion date.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. To ensure System compatibility and integrity, obtain Barrier Membrane Components and Accessories from single-source.

**2.2 SYSTEM**

- A. Manufacturer, Brand, & Material: Henry Fortifiber WeatherSmart Spun-bonded Polypropylene Sheet Membrane, Meadows Air-Shield Aluminum Sheet Membrane, or approved.
- B. Type: Drainable
- C. Physical Properties:
  - 1. ASTM D-729 - Minimum Resistance to Water Penetration Test: 60
  - 2. ASTM E84 Surface Burning Characteristics:
    - a. Flame Spread Rating Class: A
    - b. Smoke Development Classification: 105
  - 3. ASTM E-96 -Maximum Moisture Vapor Transmission: 15 perms
  - 4. ASTM E-2178 - Maximum Air Permeance @ 75 Pascals: 0.02 L/S/sqM
  - 5. ASTM E-2273 - Minimum Drainage Efficiency: 95%

**PART 2 - PRODUCTS**

**2.3 PRIMERS, ADHESIVES, SEALANTS, & FLASHINGS**

- A. Material: Recommended by System Manufacturer for conditions of use.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Verify that surfaces and conditions are ready to accept Work of this Section. Surfaces must be sound, dry, clean, and free of oil, grease, dirt, and other contaminants detrimental to Membrane-adhesion.
- B. Verify that any Concrete Curing Compounds and Release Agents are Resin-based without Oil, Wax, or Pigments.
- C. Verify that Environmental Conditions are within Manufacturer's specified limits.
- D. Prior to starting Work, notify General Contractor about defects requiring correction.
- E. Do not start Work until conditions are satisfactory.

**3.2 PREPARATION**

- A. Remove any Frost, Oil, Grease, Dirt, Mortar, and other Contaminants from Surfaces to receive Membrane.
- B. Cure Concrete to receive Barrier, if any, for 14 days (min.) before applying Barrier Primer.
- C. Reset or remove any Mechanical Fasteners if and where Fastener Heads are not flush with or recessed into Substrate Surface.

**3.3 BARRIER INSTALLATION**

- A. General: Follow Manufacturer's instructions
- B. Primary Barrier Membrane:
  - 1. Cut Membrane into manageable Sections,
  - 2. Layout Sections in horizontal and overlapping strips.
  - 3. Start at Wall bottom, work upward, and terminate at Wall-top.
  - 4. Stagger Vertical Joints.
  - 5. Minimum Joint Overlaps:
    - a. Vertical Laps: 6 to 12 inches
    - b. Horizontal Laps: 6 inches

(Cont.)



**PART 3 - EXECUTION**

**3.3 BARRIER INSTALLATION (Cont.)**

- C. Sheathing Corners:
  - 1. Over-lap Barrier at Inside and Outside Corners, and extend Laps 12 inches minimum beyond Corner.
- D. Transition Areas:
  - 1. Secure Membrane to any adjacent Beams, Columns, Floors, Parapets, Curbs, Walls, or Roofing, and elsewhere at interface between Dissimilar Materials.
- E. Rough Openings:
  - 1. Place Membrane across Opening Sills.
  - 2. Seal Inside Corners with bead of Termination Sealant.
  - 3. Install Window Sill Membrane and End-dam Terminations, and seal with Termination Sealant.
  - 4. Wrap Jamb and Head of Rough Openings with Membrane.
  - 5. Extend Membrane into Rough Openings sufficient to connect Membrane to Thermal Insulation Vapor Retarder.

**3.4 TERMINATION SEALANT APPLICATION**

- A. Seal Membrane Terminations, Penetrations, and Lap Edges with Termination Sealant.

**3.5 PROTECTION**

- A. Protect Membrane against damage and inclement weather.
- B. Membrane is not designed for permanent weather-exposure. Protect Membrane against exposure until Membrane is permanently covered.

**3.6 WASTE MANAGEMENT**

- A. Collect and place Scraps, Pallets, and Packaging Waste where directed for recycling.

**3.7 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon work completion or sooner, if directed.

**END OF SECTION**

**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 WORK INCLUDED**

- A. In accordance with governing laws, regulations, and codes; Design Loads listed in Structural Notes on Drawings; and requirements specified in Section 01-11-50; design, engineer, fabricate, and install Panels as specified herein and as shown on Drawings.

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Structural Steel Supports: Section 05-10-00
- B. Gypsum Sheathing to receive Panels: Section 06-10-00
- C. Thermal Insulation: Section 07-20-00
- D. Air Barrier System: Section 07-25-00
- E. Phenolic Wall Panels: Section 07-43-00
- F. Sheetmetal Roofing: Section 07-61-00
- G. Sheetmetal Gutters, Downspouts, & Flashing: Section 07-62-00
- H. Factory-engineered Building: Section 13-12-10

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 DESIGN REQUIREMENTS**

- A. Support actual Dead Loads plus the following Minimum Design Loads:
  - 1. Live Load: See Structural Notes on Drawings
  - 2. Snow Drift Load: Comply with Building Code
  - 3. Horizontal & Uplift Wind Loads: Comply with Building Code
  - 4. Thermal Expansion & Contraction: Resistant to stress from 100°F temperature shift.

**1.6 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**PART 1 - GENERAL**

**1.7 SHOP & ERECTION DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show Panel arrangement, Joints, types and locations of Fasteners, special Shapes, Trim Pieces, Flashing, Caulking, Color, and other pertinent Details.

**1.8 SAMPLES**

- A. Prior to ordering Products and in accordance with Section 01-33-00, submit two 12x12 inch Samples of Wall Panels.
- B. Show Corrugations and Finish.

**1.9 INSTALLER'S QUALIFICATIONS**

- A. Employed by or acceptable to Panel Manufacturer.

**1.10 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.
- B. Handle Panels with non-marring Slings.
- C. Store above ground, with one end elevated for drainage.
- D. Do not bend Panels.
- E. Protect against moisture. Do not cover with plastic.
- F. If Panels become wet, immediately separate, wipe dry with clean cloth, and continue to separate until air-dry.

**1.11 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

(Cont.)

**PART 1 - GENERAL**

**1.12 MAINTENANCE WARRANTY**

A. Prior to Final Acceptance and in accordance with Section 01-83-00, submit the following Maintenance Warranty for inclusion in Owner's Maintenance Manual:

1. We, the Undersigned, do hereby warrant for 2 years following Project Substantial Completion all Panels and related Flashing against failure due to defective materials and/or workmanship, for System to remain watertight and weatherproof, and to repair or replace without additional cost to Owner any water leaks (including leaks caused by penetrations performed by other Trades) and resulting damage to Building Materials and/or Building Contents as may occur under normal usage within Warranty Period.
2. We, the Undersigned, do hereby warrant for 10 years following Project Substantial Completion, Defective Work as specified above, but not including any damage to Building Materials or Building Contents.

PANEL SUBCONTRACTOR: \_\_\_\_\_  
By: \_\_\_\_\_

GENERAL CONTRACTOR: \_\_\_\_\_  
By: \_\_\_\_\_

3. We, the Undersigned, do hereby warrant for 25 years following Project Substantial Completion that Factory-applied Enamel Coatings on Panels will not fade, chalk, craze, chip, crack, peel, delaminate, or otherwise deteriorate.

PANEL MANUFACTURER: \_\_\_\_\_  
By: \_\_\_\_\_

**PART 2 - PRODUCTS**

**2.1 PANELS**

- A. Manufacturer: \_\_\_\_\_, or approved.
- B. Brand: \_\_\_\_\_
- C. Pattern: \_\_\_\_\_
- D. Material: \_\_\_\_\_
- E. Metal Thickness: \_\_\_\_\_
- F. Length: Full-length, single-piece between Primary Structural Members
- G. Finish: Manufacturer's standard baked-on Enamel
- H. Color: See Color Schedule on Drawings.

**PART 2 - PRODUCTS**

**2.2 METAL FLASHING**

- A. Material: Match adjacent Panels
- B. Extent of Work: Provide where necessary to weatherproof System..

**2.3 MEMBRANE FLASHING**

- A. Manufacturer: Sealex, (231) 348-5020, or approved.
- B. Brand: ImmerSeal
- C. Material: 100% RTV Silicone Rubber
- D. Extent of Work: Provide where necessary to weatherproof System.

**2.4 JOINT SEALANT**

- A. Manufacturer & Type: Recommended by Panel Manufacturer
- B. Color: Approximately match Panel color
- C. Extent of Work: Provide where necessary to weatherproof System.

**2.5 FASTENERS**

- A. Type: Screws with Waterseal Washers
- B. Material: Hot-dip galvanized Steel
- C. Length: Penetrate Structural Support at least 3/4 inch
- D. Head Color: Match adjacent Panel

**2.6 ACCESSORIES**

- A. Material: Match Panels
- B. Extent of Work: Provide Closers, Fillers, Flashing, and any other Items necessary to weatherproof System.
- C. Color: Match adjacent Materials

**2.7 FABRICATION**

- A. Unless otherwise shown on Drawings or specified herein, fabricate Panels, Flashings, and Accessories with longest practicable lengths.
- B. Factory-form Internal and External Corners to match adjacent Panels and to maintain continuity of Panel profile.
- C. Hem any exposed edges.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Members to receive Panels are complete, accurately sized and located, plumb, square, true, secure, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 ELECTROLYTIC PROTECTION**

- A. Treat Contacting Surfaces of Dissimilar Materials to prevent Corrosion.

**3.3 OTHER PROTECTION**

- A. Protect Work of other Sections against damage and discoloration caused by Work of this Section.

**3.4 PANEL INSTALLATION**

- A. General:
  - 1. Follow Manufacturer's instructions and approved Shop Drawings.
  - 2. Provide additional Struts, Stiffeners, Girts, etc. required to securely support Panels.
  - 3. Do not stretch or compress Side-lap Interlocks.
  - 4. Secure Panels flat and square to Support Members without warp or deflection.
  - 5. Align end to end before fastening permanently.
  - 6. Use sufficient Fasteners to assure rigid and permanent installation.
  - 7. Equally space and align exposed Fasteners both vertically and horizontally.
- B. Siding Panels:
  - 1. Place Corrugations horizontally.
  - 2. Overlap adjacent Panel Edges.
- C. Accessories:
  - 1. Provide as required for weathertight installation.

**3.5 ALLOWABLE ERECTION TOLERANCE**

- A. Maximum Alignment Variation: 1/4 inch in 40 ft.

**PART 3 - EXECUTION**

**3.6 FLASHING**

- A. Follow Panel Manufacturer's instructions.
- B. Overlap adjacent Panels 6 inches minimum.
- C. At any Flashing running perpendicular to Panel Ribs, notch and fold Flashing down into space between Ribs.

**3.7 CUTTING & FITTING**

- A. Perform neat, square, and true. Do not torch-cut where Cut is exposed to view.
- B. Openings 6 inches and larger in any direction: Shop-fabricate and reinforce to maintain original Load Capacity.
- C. Openings smaller than 6 inches in largest dimension: Made by Trade requiring Opening.

**3.8 TOUCH-UP**

- A. Wire-brush, clean, and paint Welds, Scarred Areas, and Rust Areas.
- B. Touch-up damaged Paint Surfaces with same Paint used in Shop. Follow Paint Manufacturer's instructions.

**3.9 WASTE MANAGEMENT**

- A. Collect and place Scraps, Pallets, and Packaging Waste where directed for recycling.

**3.10 PRODUCT CLEANING & REPAIRING**

- A. Remove loose Rust, heavy Mill Scale, Oil, Dirt, and other Bond-reducing Substances from Panels scheduled to receive Finish Painting.
- B. At completion of each day's work and at Work completion, sweep Panels, and Flashing clean. Do not allow Fasteners, Cuttings, Filings, or Scraps to accumulate on Finish Surfaces.
- C. 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.
- D. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 EXTENT OF WORK**

- A. In accordance with Drawings and Specifications; requirements specified in Section 01-11-50; governing Laws, Regulations, Codes, and Ordinances; design, engineer, furnish, and install Panel Systems, including Supports and Anchors.
- B. Installation Method: Concealed Fasteners

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Structural Steel Supports: Section Thermal Insulation: Section 07-20-00
- B. Steel Wall Panels: Section 07-41-00
- C. Sheetmetal Flashing & Trim: Section 07-62-00

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 DESIGN REQUIREMENTS**

- A. Support actual Dead Loads plus the following:
  - 1. Minimum Live Loads: See Structural Notes on Drawings.
  - 2. Horizontal Wind Loads: Comply with Building Code.
  - 3. Thermal Expansion & Contraction: Resistant to stress from 100°F Temperature Shift

**1.6 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

(Cont.)



**PART 1 - GENERAL**

**1.7 SHOP & ERECTION DRAWINGS**

- A. Submit as specified in Section 01-33-00.
- B. Show Panel the following:
  - 1. Panel sizes, arrangements, and joints.
  - 2. Trim & Cap Pieces.
  - 3. Attachments, fasteners, erection instructions, and other pertinent Details.

**1.8 SAMPLES**

- A. Submit in accordance with Section 01-33-00.
- B. Include two 12x12 inch samples showing Panel color and finish.

**1.9 CERTIFICATE OF COMPLIANCE**

- A. Submit written affidavit, signed and sealed by Engineer licensed to practice in Oregon that Work complies with specified Design Requirements.

**1.10 MAINTENANCE INSTRUCTIONS**

- A. Deliver to General Contractor for inclusion in Owner's Maintenance Manual as specified in Section 01-83-00.

**1.11 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.
- B. Handle Panels with non-marring Slings. Do not bend Panels.
- C. Store above Ground.

**1.12 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

(Cont.)

**PART 1 - GENERAL**

**1.13 MAINTENANCE WARRANTY**

- A. Prior to Final Project Acceptance submit, in accordance with Section 01-83-00, the following Maintenance Warranty for inclusion in Owner's Maintenance Manual:
1. We the Undersigned do hereby warrant for 2 years following Project Substantial Completion date all Composite Panel Work against failure due to defective materials and/or workmanship, for the System to remain watertight (including both external Water and internal Condensation), and to repair or replace without additional cost to Owner any leaks and resulting damage to Building Materials and/or Building Contents as may occur under normal usage within Warranty Period.
  2. We the Undersigned do hereby warrant for 10 years following Project Substantial Completion date that Finish will not fade, craze, chip, delaminate, or otherwise deteriorate.

PANEL SUBCONTRACTOR: \_\_\_\_\_

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

GENERAL CONTRACTOR: \_\_\_\_\_

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

**PART 2 - PRODUCTS**

**2.1 PANELS**

- A. Manufacturer: Fibresin Industries, or approved.
- B. Brand: Stonewood Architectural Panels
- C. Protective Film: Easily removable without Panel damage or discoloration.

**2.2 ACCESSORIES**

- A. Material & Color: Match adjacent Panels
- B. Extent of Work: Provide Perimeter Closures, Fillers, Flashings, Trim, and others necessary for completely enclosed and weatherproof System.

**PART 2 - PRODUCTS**

**2.3 SUBGIRTS**

- A. Material: Steel
- B. Manufacturing Standard: ASTM A-36
- C. Finish: Hot-dip galvanized in accordance with ASTM A-123
- D. Sizes & Spacings: As required by Contractor's design to support Panels, unless larger Members and/or closer Spacings are shown on Drawings.
- E. Extent of Work: Provide where necessary to support Panels.

**2.4 STIFFENERS**

- A. Material: Extruded Aluminum
- B. Size & Shape: Satisfy conditions of Contractor's design.
- C. Extent of Work: Provide behind Panel Joints and elsewhere necessary to maintain specified Panel flatness.

**2.5 ATTACHMENTS & FASTENERS**

- A. Material: Non-corrosive
- B. Type: Concealed
- C. Extent of Work: Provide all necessary for complete, secure, and weatherproof installation.

**2.6 JOINTS SEALANTS & GASKETS**

- A. Manufacturer: Made by or acceptable to Panel manufacturer.
- B. Type: Satisfy conditions of use.
- C. Extent of Work: Provide where and as necessary for weatherproof installation

**2.7 FABRICATION**

- A. Unless otherwise shown on Drawings, fabricate Components in longest practicable lengths.
- B. Factory-form any shaped-components to match adjacent Panels and to maintain continuity of Panel profile.
- C. Fabricate to provide Rain-screen Weatherproof-design, including Perimeter Extrusions and guttered Horizontal Members to drain External-water, Joint-leakage, and Condensation-water directly to System exterior.
- D. System shall not depend on caulking for Water-tightness.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Structure Members to receive Work specified herein are accurately sized and located, sound, secure, plumb, true, complete, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 ELECTROLYTIC PROTECTION**

- A. Treat Contacting Surfaces of Dissimilar Materials to prevent Corrosion.

**3.3 OTHER PROTECTION**

- A. Protect Work of other Sections against damage and discoloration caused by Work of this Section.

**3.4 INSTALLATION**

- A. Follow Manufacturer's instructions and approved Shop Drawings.
- B. Install Panels flat, square, and true against Support Members without warp, deflection, or internal stress.
- C. Align adjacent Panels and Accessories before fastening permanently.
- D. Use sufficient Fasteners to assure secure, weathertight, and permanent installation.

**3.5 ALLOWABLE ERECTION TOLERANCES**

- A. Maximum Alignment Variation: 1/4 inch per 40 ft.

**3.6 FLASHING & CAULKING**

- A. Follow Panel Manufacturer's instructions.

**3.7 WASTE MANAGEMENT**

- A. Collect and place Scraps, Pallets, and Packaging Waste where directed for recycling.

**PART 3 - EXECUTION**

**3.8 PRODUCT CLEANING & REPAIRING**

- A. Remove Protective Film as soon as possible following Work completion.
- B. Verify that Weep Holes are open.
- C. Remove Dirt and other Foreign Substances from Panels.
- D. 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.
- E. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 EXTENT OF WORK**

- A. Provide over Horizontal Roof Decks.
- B. Installation Method: Mechanically attached

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Sheetmetal Roofing: Section 07-61-00
- B. Sheetmetal Flashing & Trim: Section 07-62-00
- C. Roof Accessories: Section 07-72-00
- D. Plastic Skylights: Section 08-62-00
- E. Translucent Panel Skylights: Section 08-64-00
- F. Roof Drains, Inside Conductors, & Flashing around Piping & Ducts passing through Roof: See Plumbing & HVAC Specifications

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 REFERENCED SPECIFICATIONS**

- A. Roofing:
  - 1. Unless otherwise specified, comply with applicable portions of Recommended Performance Criteria for Elastomeric Single Ply Roof Membrane System document ME-20, published by Midwest Roofing Contractors Assn.; 7250 Poe Ave.; Suite 410; Dayton, OH 45414; (800) 497-6722.. Copies of Specification can be obtained from Association.
  - 2. Wherever the word "should" appears it shall mean "shall".
- B. Thermal Roof Insulation:
  - 1. Test Method for determining Aged Thermal Resistance Values (R) of Insulation: 15 year time-weighted Long Term Thermal Resistance (LTTR) average as stipulated in ASTM C-1289.

**PART 1 - GENERAL**

**1.6 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.7 REGULATORY AGENCY REQUIREMENTS**

- A. Comply with International Code Council Evaluation Service (ICC-ES) requirements and with wind-uplift and other Building Code requirements if more restrictive than those specified herein. Notify Architect about differences before starting work.
- B. Comply with OSHA Fall Protection Requirements.
- C. Label Products indicating compliance with U.L. fire-resistive requirements specified in Building Code.

**1.8 SUBMITTALS**

- A. With each Subbid proposal, submit Roofing Manufacturer's Certificate of Roofing Applicator Approval.
- B. At least 2 weeks prior to Roofing, submit to Architect, in accordance with Section 01-60-00, 1 copy of each of the following:
  - 1. Roofing Manufacturer's applicable Installation Specifications
  - 2. Roofing Manufacturer's Certificate of Roofing Applicator approval
  - 3. Roofing Manufacturer's Affidavit that supplied Products comply with these Specifications
- C. Immediately following Work completion submit to Architect:
  - 1. Certification that Manufacturer's Representative has inspected Work prior to, during, and after Work completion, and that Work complies with these Specifications and Manufacturer's instructions.
- D. In accordance with Section 01-83-00, submit the following to General Contractor for inclusion in Owner's Maintenance Manual:
  - 1. Roofing Maintenance Warranty as specified below
  - 2. Roofing Maintenance Instructions

(Cont.)

**PART 1 - GENERAL**

**1.9 PRE-INSTALLATION MEETING**

- A. Prior to starting work, and in accordance with Section 01-31-50, Roofer shall arrange meeting to clarify any questions about Specifications, details, and other application requirements.
- B. Representatives of the following shall attend:
  - 1. General Contractor
  - 2. Roofing Subcontractor
  - 3. Roofing Manufacturer
  - 4. General Sheetmetal Subcontractor
  - 5. Roof-mounted Equipment Subcontractors
  - 6. Roof-penetrating Equipment Subcontractors.

**1.10 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Deliver in unopened original packaging, with Manufacturer's legible labels thereon.
- B. Protect against damage, discoloration, and moisture.
- C. Do not cut, tear, or puncture Roofing.
- D. Store under Protective Coverings and above ground on Pallets.
- E. Store Adhesives and Flashing Materials between 60°F and 80°F for at least 4 hours immediately prior to installation.
- F. Protect Foam Insulation against Fire and direct Sunlight exposure.
- G. Protect Foam Insulation edges against crushing and breaking.
- H. Do not stack Foam Insulation higher than 8 ft.
- I. Maintain clear aisle space between Foam Insulation Stacks to facilitate Fire Suppression.
- J. Weight Foam Insulation as required to prevent wind-induced damage.
- K. Do not overload Building Structure with stored Materials.

**1.11 WEATHER REQUIREMENTS**

- A. Comply with Manufacturer's recommendations.

**1.12 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.



**PART 1 - GENERAL**

**1.13 ADVANCE NOTICES**

- A. Notify Architect and Roofing Manufacturer at least 2 working days before starting work.

**1.14 WORK WARRANTY**

- A. Roofing and Flashings are subject to 2 year Warranty called for in Supplementary Conditions, Section 00-80-00.
- B. Roofer is responsible for proper placement of Metalwork, which has been provided by other Trades, and is in contact with Roofing.

**1.15 MAINTENANCE WARRANTY**

- A. Prior to Final Project Acceptance submit, in accordance with Section 01-83-00, the following Warranties for inclusion in Owner's Maintenance Manual:
1. We, the undersigned, do hereby warrant Single Ply Roofing and related Roof Insulation and Flashing against failure under normal usage as may occur within the following time periods after Project Substantial Completion date, and defective Work will be repaired or replaced at no additional cost to Owner:
- a. 2 Years: Defective Work including any resulting damage to Building Materials and/or Building Contents.

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

GENERAL CONTRACTOR: \_\_\_\_\_  
By: \_\_\_\_\_

- b. 10 Years: Defective Work, but not including any damaged Building Materials or Building Contents.

ROOFING MANUFACTURER: \_\_\_\_\_  
By: \_\_\_\_\_

(Cont.)

**PART 2 - PRODUCTS**

**2.1 AIR BARRIER**

- A. Material: 6 Mil Thick Polyurethane Film
- B. Extent of Work: Provide between Steel Roof Deck and Roof Thermal Insulation.

**2.2 METAL ROOF DECK SHEATHING**

- A. Manufacturer & Brand: G-P DensDeck Prime Roof Board, or approved.
- B. Minimum Thickness: As recommended by Sheathing Manufacturer for conditions of use.
- C. Flame Spread Rating: 0
- D. Smoke Development Rating: 0
- E. Maximum ASTM C-473 Water Absorption by weight: 5%
- F. Maximum ASTM C-473 Surface Water Absorption: 1 gram
- G. Extent of Work: Provide over Deck Surfaces to receive Roofing.

**2.3 VAPOR RETARDER**

- A. Manufacturer & Brand: Reef Griffolyn, or approved.
- B. Maximum Perm Rating: 0.01

**2.4 ROOF INSULATION**

- A. Manufacturer & Brand: Contractor's choice
- B. Insulating Material: Polyisocyanurate Foam
- C. Manufacturing Standard: ASTM C-1289, Type II, Class 1
- D. Minimum Compressive Strength: 20 psi
- E. Facing Material: Coated Fiberglass
- F. Type: Free of CFC's & HCFC's
- G. Top Surface Shape: Untapered
- H. Total Overall Thickness: 6 inches

**2.5 INSULATION COVER BOARD**

- A. Manufacturer & Brand: G-P DensDeck Roof Board, or approved.
- B. Thickness: 1/4 inches
- C. Flame Spread Rating: 0
- D. Smoke Development Rating: 0
- E. Maximum ASTM C-473 Water Absorption by weight: 5%
- F. Maximum ASTM C-473 Surface Water Absorption: 1 gram
- G. Extent of Work: Provide over Thermal Insulation to receive Roofing.

**PART 2 - PRODUCTS**

**2.6 CRICKET FORMING BOARD**

- A. Material: Polyisocyanurate Insulation Board, or approved.
- B. Manufacturer: Contractor's choice
- C. Minimum Density: 1-1/2 pcf
- D. Shape: Tapered 1/2 inch per ft., minimum.
- E. Extent of Work: Provide where necessary to form Roof Slope Crickets.

**2.7 ROOFING MEMBRANE**

- A. Manufacturer & Brand: Carlisle Sure-Weld, Firestone UltraPly, JM UltraGuard, Stevens EP, or approved.
- B. Material: Reinforced Thermoplastic Polyolefin (TPO)
- C. Manufacturing Standard: ASTM D-6878
- D. Minimum UL 790 Fire-resistiveness Class: A
- E. Color: White
- F. Minimum Solar Reflectance Index (SRI) after 3-years Weather Exposure: 0.74
- G. Thickness: 60 mils

**2.8 FLASHING MEMBRANE**

- A. Material & Thickness: Recommended by Roofing Membrane Manufacturer for conditions of use.
- B. Color: Match Roofing Membrane

**2.9 ADHESIVE, CEMENT, MASTIC, & SEALANT**

- A. Furnished by Membrane Manufacturer.

**2.10 NAILING STRIPS, CURBS, & BLOCKING**

- A. Materials: Recommended by Membrane Manufacturer for conditions of use
- B. Source: Furnished by Membrane Manufacturer

(Cont.)

**PART 2 - PRODUCTS**

**2.11 FASTENERS**

- A. Manufacturer & Type: Approved by Membrane Manufacturer
- B. Material: Non-corrosive
- C. Length: As required to satisfy conditions of use. Note: If and where underside of Roof Sheathing is exposed to view, provide short Fasteners that will not be visible.

**2.12 TRAFFIC PADS**

- A. Manufacturer & Brand: Carlisle Walkway Pads, or approved.
- B. Approximate Minimum Face Size: 30x30 inches
- C. Extent of Work: Provide on Roof surface in 30 inch minimum wide strip around Roof-mounted Mechanical Equipment requiring maintenance and where necessary to connect Equipment with Roof Access Hatch.

**2.13 OTHER MATERIALS**

- A. Manufacturer & Type: Approved by Membrane Manufacturer
- B. Extent of Work: Provide all required for complete weatherproof installation.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces to receive Roofing System are clean, smooth, sound, dry, and free of sharp edges, fins, grease, oil, water, ice, frost, foreign matter, and other conditions that could adversely affect Roofing execution and permanence, and are otherwise properly prepared.
- B. Prior to starting Work notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.
- D. Do not start until other Work which penetrates Membrane is completed.

**3.2 PROTECTION**

- A. Protect other Work against damage and discoloration caused by Work of this Section.
- B. Prevent Adhesive Solvent Fumes from being drawn into Building Ventilation System.

**PART 3 - EXECUTION**

**3.3 SURFACE PREPARATION**

- A. Prior to roofing, remove from Roof Deck any oil, grease, debris, obstruction, snow, ice, moisture, or projections which could damage System.

**3.4 SHEATHING INSTALLATION**

- A. Position Sheathing Edges so they are supported by Roof Decking.
- B. Mechanically fasten to Substrate in accordance with Regulatory Agency requirements.

**3.5 VAPOR RETARDER INSTALLATION**

- A. Apply, in accordance with Membrane Manufacturer's instructions, over Decks to receive Thermal Insulation.
- B. Minimum Side Laps: 2 inches
- C. Minimum End Laps: 6 inches
- D. Seal Edge, Perimeter, and Penetration Laps with Adhesive.

**3.6 INSULATION INSTALLATION**

- A. General:
  - 1. Apply in dry condition in accordance with Manufacturer's instructions and Regulatory Agency requirements.
  - 2. Apply in 2 or more layers to specified overall thickness.
  - 3. Stagger Joints between adjacent Insulation layers at least 8 inches.
  - 4. Maximum Open Space between adjacent Insulation Sheets: 1/8 inch
  - 5. Position long sides of Insulation Sheets with Continuous Joints. Stagger adjacent Transverse Joints.
  - 6. Neatly cut and fit Insulation at Roof Edges and at any Vertical Projections through Insulation. Fill Open Spaces with Edge Expansion Strips.
  - 7. Miter Insulation at any Ridges.
  - 8. Do not damage Insulation edges or faces during installation.
- B. At Steel Decks:
  - 1. Position Boards so that Board Joints are supported by Deck.
- C. At Roof Drains:
  - 1. Taper top layer of Insulation for 24 inches around and downward toward Drain.

**3.7 INSULATION COVER BOARD INSTALLATION**

- A. Apply to Roof Insulation in accordance with Manufacturers' instructions.

**PART 3 - EXECUTION**

**3.8 CRICKET BOARD INSTALLATION**

- A. Form into shapes shown on Drawings, and apply to Roof Insulation in accordance with Manufacturers' instructions.
- B. Maintain 1/2 inch per ft. minimum slope at Cricket Valleys.

**3.9 MEMBRANE INSTALLATION**

- A. Follow Manufacturer's instructions using Mechanically Attached method.
- B. Place Sheet in final position without stretching.
- C. Allow Sheets to relax 30 minutes minimum before making splices or anchoring to Substrate.
- D. Overlap adjacent Sheets at least 3 inches for splicing.
- E. Remove any Wrinkles or Air Pockets.
- F. Secure Membrane as instructed by Membrane Manufacturer.
- G. Make Seams and Penetrations watertight.
- H. Check Seam sealing for continuity and integrity.
- I. Prior to end of each Working Day, seal exposed Seam edges with Sealant.
- J. Flash Membrane perimeter and penetrations as instructed by Membrane Manufacturer.

**3.10 TRAFFIC PAD INSTALLATION**

- A. Space Pads approximately 6 inches apart to permit Water-flow.
- B. Do not install directly over field-fabricated Roofing Seams.
- C. Secure to Roofing with Adhesive recommended by Roofing Manufacturer.

**3.11 PROTECTING COMPLETED WORK**

- A. Prevent Water-flow beneath or behind any completed Work.
- B. Notify General Contractor to protect completed Work against damage and discoloration caused by workmen of other Trades.
- C. To any Roof-mounted Mechanical Equipment, conspicuously locate and apply brightly colored Decal, which warns Equipment Maintenance Workers against spilling Liquid Freon, Petroleum-based Products, and other Materials which can damage Roofing Membrane.

**3.12 WASTE MANAGEMENT**

- A. Collect and place Scraps, Pallets, and Packaging Waste where directed for recycling.

**PART 3 - EXECUTION**

**3.13 CLEANING & REPAIRING**

- A. 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.
- B. Remove debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Thermal Insulation: Section 07-20-00
- B. Single-ply Roofing: Section 07-53-00
- C. Sheetmetal Flashing & Trim: Section 07-62-00
- D. Plastic Skydomes: Section 08-62-00
- E. Translucent Panel Skylights: Section 08-64-00
- F. Roof Drains, Inside Conductors, & Flashing around Piping and Ducts passing through Roof: See Plumbing & HVAC Specifications

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 REFERENCED REQUIREMENTS**

- A. Comply with minimum requirements specified in "Architectural Sheet Metal Manual", published by SMACNA.

**1.6 DESIGN REQUIREMENTS**

- A. In accordance with governing laws, regulations, codes, and requirements specified in Section 01-11-50; design, engineer, and construct Sheetmetal Roofing System to support actual Dead Loads plus the following Design Loads:
  - 1. Design Loads indicated in Structural Notes located on Drawings.
  - 2. Horizontal & Uplift Wind Loads: Comply with Building Code
  - 3. Thermal Expansion & Contraction: Resistant to stress from 120°F temperature shift without over-stressing Roofing or Fasteners.
  - 4. Maximum Deflection: 1/480 of Span



**PART 1 - GENERAL**

**1.7 PERFORMANCE REQUIREMENTS**

- A. Prevent Sheet Metal buckling, oil-canning, joint-opening, over-stressing, attachment-failure, and other detrimental effects caused by thermally-induced-movement induced by Solar Heat Gain and Night-time Heat Loss temperature changes.
- B. Design, engineer, and construct System to comply with the following:
  - 1. Maximum ASTM E-283 Air Infiltration at 20 psf: 0.010 cfm per sq. ft.
  - 2. Maximum ASTM E-331 Water Penetration at 20 psf: No visible leakage

**1.8 REGULATORY AGENCY REQUIREMENTS**

- A. Comply with Wind Uplift and other Building Code requirements if more restrictive than those specified herein. Notify Architect about differences before starting work.
- B. Comply with OSHA Fall Protection Requirements.

**1.9 SAMPLES**

- A. Submit in accordance with Section 01-33-00.
- B. Include two 12x12 inch samples of Sheetmetal Material showing pattern, color, and thickness.

**1.10 INSTALLER'S QUALIFICATIONS**

- A. To be eligible to perform Work specified herein Installer must have successfully completed at least 2 similar projects.

**1.11 PRE-APPLICATION MEETING**

- A. Prior to roofing, and in accordance with Section 01-31-50, Roofer shall arrange Meeting to clarify any questions about Specifications, details, and application requirements.
- B. Representatives of the following shall attend:
  - 1. General Contractor
  - 2. Thermal Insulation Subcontractor
  - 3. Roofing Subcontractor
  - 4. Sheetmetal Flashing & Trim Subcontractor
  - 5. Roof-mounted Equipment Subcontractors
  - 6. Roof-penetrating Equipment Subcontractors

**PART 1 - GENERAL**

**1.12 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Package Factory-painted Materials with Non-sticking Paper or Strippable Film Coating between adjacent Sheets.
- B. Protect against damage and discoloration.
- C. Do not bend, warp, or twist Panels.
- D. Ventilate stored Panels as required to prevent Condensation build-up between Panels.
- E. Do not overload Roof Structure with Stored Materials.

**1.13 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**1.14 MAINTENANCE WARRANTY**

- A. Prior to Final Acceptance and in accordance with Section 01-83-00, submit the following Maintenance Warranty for inclusion in Owner's Maintenance Manual:
  - 1. We, the Undersigned, do hereby warrant for 2 years following Project Substantial Completion all Sheetmetal Roofing and related Sheetmetal Flashing against failure due to defective materials and/or workmanship, for System to remain watertight and weatherproof, and to repair or replace without additional cost to Owner any water leaks (including leaks caused by penetrations performed by other Trades) and resulting damage to Building Materials and/or Building Contents as may occur under normal usage within Warranty Period.
  - 2. We, the Undersigned, do hereby warrant for 10 years following Project Substantial Completion, Defective Work as specified above, but not including any damage to Building Materials or Building Contents.
  - 3. We, the Undersigned, do hereby warrant for 10 years following Project Substantial Completion against defective Fall Protection Work, including any damage to any adjacent Landscaping or Vehicles, or injury to Individuals.  
ROOFER: \_\_\_\_\_  
By: \_\_\_\_\_  
GENERAL CONTRACTOR: \_\_\_\_\_  
By: \_\_\_\_\_
  - 4. We, the Undersigned, do hereby warrant for 25 years following Project Substantial Completion that Factory-applied Enamel Coatings on Sheetmetal will not fade, chalk, craze, chip, crack, peel, delaminate, or otherwise deteriorate.  
ROOFING MANUFACTURER: \_\_\_\_\_  
By: \_\_\_\_\_

**PART 2 - PRODUCTS**

**2.1 GALVANIZED STEEL SHEETS**

- A. Metal Manufacturing Standards: ASTM A-653
- B. Quality: Lock-forming
- C. Pattern: Smooth without texture
- D. Minimum Galvanizing Coating Designation: G-90
- E. Minimum Metal Thickness: 24 ga.
- F. Factory-applied Finish where exposed to Ground Level View:
  - 1. Material: Fluoropolymer Enamel complying with AAMA 2605
  - 2. Minimum polyvinylidene (PVDF) Content: 70%
  - 3. Minimum Dry Film Thickness: 1.2 mils
  - 4. Color: See Color Schedule on Drawings.

**2.2 STAINLESS STEEL SHEETS**

- A. Manufacturing Standard: ASTM A-167
- B. Type: 304
- C. Temper: Soft (fully annealed)
- D. Finish: 4D (dull)
- E. Thickness: 26 ga.(0.0187 inches)
- F. Pattern: Smooth without texture

**2.3 FASTENERS**

- A. Type: Screws
- B. Manufacturing Standard: Fed. Spec. FF-S-107
- C. Head: Flat
- D. Material: Match adjacent Cleat Material.
- E. Minimum Size: No. 7
- F. Minimum Length: 1 inch

**2.4 PRIME COATING & UNDERCOATING**

- A. Material: Galvanized Primer specified in Section 09-90-00

**2.5 ASPHALT COATING COMPOUND**

- A. Manufacturing Standard: Fed. Spec. TT-C-153
- B. Type: II

**PART 2 - PRODUCTS**

**2.6 UNDERLAYMENT**

- A. Manufacturer: Henry, or approved.
- B. Brand: Blueskin PE200HT
- C. Surface Material: Cross-laminated Polyethylene Film
- D. Minimum Performance Standard: ASTM D-1970

**2.7 SLIP SHEET**

- A. Material: Smooth, rosin-sized Kraft Paper.
- B. Minimum Weight: 4 lbs. per 100 sq. ft.

**2.8 FALL PROTECTION SYSTEM**

- A. Manufacturer: Super Anchor Safety, or approved/
- B. Model: RS-20
- C. Extent of Work: Provide at Roofing Ridge Line.

**2.9 FABRICATION**

- A. General:
  - 1. Form to shapes and dimensions shown with planes and lines in true alignment.
  - 2. Unless otherwise shown on Drawings or specified, fabricate with longest practicable lengths.
  - 3. Hem exposed edges.
- B. Cleats:
  - 1. Material: 28 ga. Stainless Steel.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Do not proceed until surfaces to receive Roofing are smooth, sound, clean, dry, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**PART 3 - EXECUTION**

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 PAINTING**

- A. Protect contacting dissimilar Metals against Galvanic Corrosion with Asphaltic Compound, 7-1/2 mil dry film minimum thickness, applied to each contacting Metal Face.
- B. Protect Metals against Oxidation by back-painting with Galvanized Iron Primer as specified in Section 09-90-00.

**3.4 WORKMANSHIP**

- A. Form to shapes and dimensions shown, free from defects which impair strength or mar appearance.
- B. Form Planes and Lines to true alignment.

**3.5 INSTALLATION**

- A. General:
  - 1. Install Plane Surfaces and Seams without waves, warps, buckles, tool marks, fastening stresses, or distortion, allowing fully for Material expansion and contraction.
- B. Underlayment:
  - 1. Secure to Roof Deck with minimum possible anchorage.
  - 2. Lap Joints 2 inches minimum, and install in direction of water-flow.
- C. Slip Sheets:
  - 1. Install over Underlayment, and secure with minimum possible anchorage.
  - 2. Lap Joints 2 inches minimum in direction of water-flow.
- D. Roof Panels:
  - 1. Install in full-length single-piece lengths over Slip Sheets, and secure to Substrate with Cleats spaced at 12 inch centers.
  - 2. Secure Cleats with 2 Fasteners to prevent Cleat rotation, and cover Fastener Heads with Cleat Tabs.
  - 3. Flash Roof Penetrations with Material matching Roof Panels, and make watertight by soldering.
  - 4. Anchor Panels to Substrate at Ridge to prevent Panel slippage.
  - 5. Hem bottom edge of Panel and secure to Substrate with Clip.

(Cont.)

**PART 3 - EXECUTION**

**3.5 INSTALLATION (Cont.)**

- E. Seams:
  - 1. General: Form in direction of water-flow; make watertight.
  - 2. Longitudinal Seams:
    - a. Type: 5-ply double locked standing.
    - b. Height: 2 inches
    - c. Approximate Spacing between adjacent Seams: 18 inches
  - 3. Ridge Treatment: Finish with Standing Seams.
- F. Soldering:
  - 1. At Factory-painted Sheetmetal: Substitute Sealant in lieu of soldering.
  - 2. Elsewhere:
    - a. Clean and flux Metals prior to soldering.
    - b. Sweat Solder completely through Seam widths using Soldering Iron not Torch which can over-heat Sheetmetal.

**3.6 FALL PROTECTION SYSTEM INSTALLATION**

- A. Follow Manufacturer's instructions.

**3.7 PROTECTING COMPLETED WORK**

- A. Do not store Material or allow traffic on completed Roof surfaces.

**3.8 WASTE MANAGEMENT**

- A. Collect and place Scraps, Pallets, and Packaging Waste where directed for recycling.

**3.9 CLEANING & REPAIRING**

- A. As Work progresses, neutralize excess Flux with 5% to 10% Washing Soda Solution, and thoroughly rinse.
- B. Immediately after installation remove Protective Covering from Factory Painted Sheetmetal.
- C. Touch-up any exposed Bare Metal or Soldered Joints to match Factory Finish.
- D. 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.
- E. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 PRODUCTS FURNISHED, BUT INSTALLED UNDER OTHER SECTIONS**

- A. Sheet Metal built into Roofing.

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Wood Curbing: Section 06-10-00
- B. Flashing for Metal Panels: Section 07-41-00
- C. Flashing for Phenolic Panels: Section 07-43-00
- D. Single-Ply Roofing: Section 07-53-00
- E. Sheet Metal Roofing: Section 07-61-00
- F. Roof Accessories: Section 07-72-00
- G. Plastic Skylights: Section 08-62-00
- H. Translucent Panel Skylights: Section 08-64-00
- I. Field Painting: Section 09-90-00
- J. Roof Drains, Inside Conductors, & Flashing around Piping passing through Roof: See Plumbing Specifications

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.6 REGULATORY AGENCY REQUIREMENTS**

- A. Comply with OSHA Fall Protection Requirements.

**PART 1 - GENERAL**

**1.7 REFERENCED REQUIREMENTS**

- A. Comply with minimum requirements specified in “Architectural Sheet Metal Manual”, published by SMACNA.

**1.8 PERFORMANCE REQUIREMENTS**

- A. Prevent Sheet Metal buckling, oil-canning, joint-opening, over-stressing, attachment-failure, and other detrimental effects caused by thermally-induced-movement induced by Solar Heat Gain and Night-time Heat Loss temperature changes.

**1.9 SAMPLES**

- A. Prior to starting Work and in accordance with Section 01-33-00, submit two 12x12 inch samples of Factory-painted Sheetmetal.
- B. Show color and thickness.

**1.10 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Package Factory-painted Materials with Non-sticking Paper or Strippable Film Coating between adjacent Sheets.
- B. Protect against damage and discoloration.
- C. Do not bend, warp, or twist Sheets.
- D. Ventilate stored Sheets as required to prevent Condensation build-up between Sheets.
- E. Do not overload Roof Structure with Stored Materials.

**1.11 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

(Cont.)



**PART 1 - GENERAL**

**1.12 MAINTENANCE WARRANTY**

- A. Prior to Final Acceptance and in accordance with Section 01-83-00, submit the following Maintenance Warranty for inclusion in Owner's Maintenance Manual:
1. We, the Undersigned, do hereby warrant for 2 years following Project Substantial Completion all Sheetmetal Flashing against failure due to defective materials and/or workmanship; for System to remain watertight and weatherproof; and to repair or replace without additional cost to Owner any water leaks and resulting damage to Building Materials and/or Building Contents as may occur under normal usage within Warranty Period.
  2. We, the Undersigned, do hereby warrant for 10 years following Project Substantial Completion, Defective Work as specified above, but not including any damage to Building Materials or Building Contents.  
FLASHING SUBCONTRACTOR: \_\_\_\_\_  
By: \_\_\_\_\_  
GENERAL CONTRACTOR: \_\_\_\_\_  
By: \_\_\_\_\_
  3. We, the Undersigned, do hereby warrant for 25 years following Project Substantial Completion that Factory-applied Enamel Coatings on Sheet Metal will not fade, chalk, craze, chip, crack, peel, delaminate, or otherwise deteriorate.  
FLASHING MANUFACTURER: \_\_\_\_\_  
By: \_\_\_\_\_

**PART 2 - PRODUCTS**

**2.1 GALVANIZED STEEL SHEETS**

- A. Metal Manufacturing Standards: ASTM A-653
- B. Quality: Lock-forming
- C. Pattern: Smooth without texture
- D. Minimum Galvanizing Coating Designation: G-90
- E. Minimum Metal Thickness: Specified below
- F. Factory-applied Finish where exposed to Ground Level View:
1. Material: Fluoropolymer Enamel complying with AAMA 2605
  2. Minimum polyvinylidene (PVDF) Content: 70%
  3. Minimum Dry Film Thickness: 1.2 mils
  4. Color: Match adjacent Sheet Metal Roofing specified in Section 07-61-00.

**PART 2 - PRODUCTS**

**2.2 STAINLESS STEEL SHEETS**

- A. Manufacturing Standard: ASTM A-167
- B. Type: 304
- C. Temper: Soft, fully annealed.
- D. Thickness: Specified below
- E. Finish: 2D, dull.
- F. Pattern: Flat without texture

**2.3 NAILS**

- A. Manufacturing Standard: Fed. Spec. FF-N-105B
- B. Type: Barbed, slating.
- C. Head: Flat
- D. Material: Stainless Steel Wire
- E. Minimum Length: 1 inch

**2.4 SCREWS**

- A. Manufacturing Standard: Fed. Spec. FF-S-107
- B. Type: Self-tapping
- C. Head: Pan
- D. Material: Stainless Steel
- E. Minimum Size: No. 7
- F. Minimum Length: 1 inch

**2.5 RIVETS**

- A. Type: As required by conditions of use
- B. Material: Stainless Steel
- C. Minimum Diameter: 1/8 inch
- D. Length: Recommended by Rivet Manufacturer for conditions of use

**2.6 SEALANT**

- A. Manufacturer & Brand: Dow 999-A, GE Silicone II, Mameco Vulkem 116, Ruscoe Permanent Sealer, Sonneborn NP-1, Tremco Gutter Seal, or approved.

**PART 2 - PRODUCTS**

**2.7 SOLDER**

- A. Manufacturing Standard: ASTM B-32
- B. At Stainless Steel:
  - 1. Lead Content: 30%
  - 2. Tin Content: 70%
- C. At Galvanized Steel:
  - 1. Lead Content: 50%
  - 2. Tin Content: 50%

**2.8 FLUX**

- A. Material: Rosin, cut Muriatic Acid, or Commercial Preparation suitable for use.

**2.9 ASPHALT PLASTIC CEMENT**

- A. Manufacturing Standard: Fed. Spec. SS-C-153
- B. Type: I

**2.10 PRIME COATING & UNDERCOATING**

- A. For Galvanized Steel: Galvanized Primer specified in Section 09-90-00
- B. For Stainless Steel: Zinc Chromate Primer specified in Section 09-90-00

**2.11 ASPHALT COATING COMPOUND**

- A. Manufacturing Standard: Fed. Spec. TT-C-494
- B. Type: II

**2.12 DOWNSPOUT STRAINERS**

- A. Type: Removable Wire Basket
- B. Material: 0.054 inch minimum diameter Stainless Steel Wire
- C. Extent of Work: Tightly fit in each Sheet Metal Downspout Inlet.

## **PART 2 - PRODUCTS**

### **2.13 FABRICATION**

- A. General:
  - 1. Form to shapes and dimensions shown with planes and lines in true alignment.
  - 2. Unless otherwise shown on Drawings or specified, fabricate with longest practicable lengths.
  - 3. Form Openings Head and Sill Flashing with End Dams.
  - 4. Hem exposed edges.
  - 5. Angle bottom edges of vertical surfaces to form drip.
- B. Seams:
  - 1. Common Lock Seams: 3/4 inch finish width; 4-ply loose-locked.
  - 2. Flat Lock Seams: 5/8 inch finish width; 4-ply flat locked, malletted tight; sweat full with Solder.
  - 3. Single Corner Seams: 3/4 inch finish width; 3-ply loose locked.
  - 4. Double Corner Seams: 5/8 inch finish width; 4-ply loose locked.
  - 5. Lap Seams: 3 inch finish width.
  - 6. Solder-Lap Seams: 1 inch finish width; sweat full with Solder.
  - 7. Cover Plate Seams:
    - a. Space abutting Sheets 1/2 inch; cover Joint with 4 inch wide Cover and Back-up Plates set in Sealant.
    - b. Match Plates to Flashing profile.
    - c. Secure Plates to Substrate with Screw installed through Open Space between adjacent Flashing Sheets.
  - 8. S-Lock Seams: Form 1-1/4 inch wide "S" shaped Seam on one edge of Flashing Sheet for concealed fastening.
- C. Cleats:
  - 1. Material: 28 ga. Stainless Steel.

## **PART 3 - EXECUTION**

### **3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces to receive Sheet Metal are smooth, clean, and otherwise properly prepared.
- B. Verify that Nailers to receive Sheet Metal are properly placed.
- C. Prior to starting Work notify General Contractor of defects that require correction.
- D. Do not start Work until conditions are satisfactory.

### **3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

### **3.3 INSTALLATION, GENERAL**

- A. Install Work watertight, without waves, warps, buckles, tool marks, fastening stresses, distortion, or defects which impair strength or mar appearance.
- B. Install planes and lines in true alignment.
- C. Allow for Sheet Metal expansion and contraction.

### **3.4 CLEAT INSTALLATION**

- A. Space 2 ft on center, unless continuous Cleats or other spacings are specified hereunder.
- B. Secure spaced Cleats to Substrate with 2 Fasteners to prevent Cleat rotation.
- C. Secure Continuous Cleats to Substrate with Fasteners spaced at 12 inch maximum centers.
- D. Cover Fastener Heads with Cleat Tabs folded back over Fastener Head.

### **3.5 SOLDERING**

- A. At Factory-painted Sheetmetal: Substitute Sealant in lieu of soldering.
- B. Elsewhere:
  - 1. Clean and flux Metals prior to soldering.
  - 2. Sweat Solder completely through Seam widths using Soldering Iron not Torch which can over-heat Sheetmetal.

### **3.6 SEALANT INSTALLATION**

- A. Apply 1/4 inch diameter Bead, centered in full length of Joint.

### **3.7 ASPHALT PLASTIC CEMENT INSTALLATION**

- A. Trowel apply 1/8 inch thick.

### **3.8 PAINTING**

- A. If and where Sheet Metal is scheduled to receive Field Painting, shop-apply Primer Coat as specified in Section 09-90-00. Minimum Primer Coat Dry Film Thickness: 1-1/2 mils.
- B. Protect Galvanized Steel against corrosion with Asphaltic Coating Compound. Minimum Dry Film Thickness applied to each Contacting Face: 7-1/2 mils

**PART 3 - EXECUTION**

**3.9 COUNTER FLASHING**

- A. Form of 24 ga. Galvanized Steel.
- B. Overlap Base Flashing 4 inches minimum.
- C. Install Bottom Edge spring-tight against Base Flashing, or at Contractor's option secure Bottom Edge with 1 inch wide Clips spaced no greater than 24 inch o.c. Attach Clips to Substrate with concealed Fasteners. Reinforce Clips by double-bending Clip 3/4 inch back over bottom edge of Counter Flashing.
- D. Lap-seam Vertical Joints, and apply Sealant.
- E. Miter, Lap-seam, and close Corner Joints with Solder.
- F. Provide where Roof abuts Vertical Surfaces, and elsewhere shown on Drawings.

**3.10 APRON FLASHING WHERE ROOF SLOPES AWAY FROM VERTICAL SURFACE**

- A. Form of 24 ga. Galvanized Steel.
- B. Extend up Vertical Surface 4 inches minimum and onto Roof Surface 4 inches minimum.
- C. Secure top edge to Wall Sheathing.
- D. Hem bottom edge 1/2 inch.
- E. Lap-seam Vertical Joints 3 inches minimum.
- F. Engage hemmed edges.
- G. Miter Flashing and extend around Corner 3 inches minimum, and solder Joints.
- H. Install Bottom Edge spring-tight against Roofing.

**3.11 COPINGS**

- A. Form of 24 ga. Galvanized Steel.
- B. Fabricate with Cover Plate Seams spaced approximately 10 ft. apart.
- C. Miter and join Corners with Cover Plate Seams.
- D. Lock Exterior Edges over Continuous Cleats secured to Substrate.
- E. Lock Interior Edges over Spaced Cleats secured to Substrate.
- F. Slope Coping top to drain toward Roof.

(Cont.)

**PART 3 - EXECUTION**

**3.12 PARAPET WALL COVERING**

- A. Form of 24 ga. Galvanized Steel.
- B. At Parapet Walls 24 inches & Higher: Fabricate with vertical S-lock Seams spaced approximately 2 ft. apart.
- C. At Parapet Walls lower than 24 inches: Fabricate with continuous Horizontal Seams.
- D. Anchor Seams to Substrate with Cleats spaced 12 inches apart, maximum.
- E. Hook top edge of Covering into hemmed edge of Coping.
- F. Attach bottom edge of Covering to top of Counter Flashing with Common Lock Seams.
- G. Bend Covering around Corners 12 inches, minimum.
- H. Cover inside face of Parapet Walls, unless otherwise shown on Drawings.

**3.13 THRU-WALL SCUPPERS**

- A. Form of 26 ga. Stainless Steel.
- B. Line Opening and slope toward Drain.
- C. Join Liner to Inside Flange with flat Lock Seams; extend Inside Flange 4 inches on top of Roofing and 4 inches in all other directions.
- D. Secure Roof Flange to Substrate with Nails spaced 6 inches apart.
- E. Join Liner to Outside Flange with Single Corner Seams.
- F. Extend Outside Flange 1-1/2 inches in all directions.
- G. Counterflash top edges of Inside and Outside Flanges, or if not practicable, make watertight with Sealant installed between Flange and Wall face.

**3.14 HUNG GUTTERS**

- A. Form to detail of 24 ga. Galvanized Steel.
- B. Lap Gutter Joints 1 inch minimum, rivet, and solder.
- C. Locate Gutter Front Edge 1/2 inch minimum lower than Rear Edge.
- D. Stiffen Gutter Front Edge with hemmed return.
- E. Counterflash Gutter Rear Edge.
- F. Secure End Caps with 1 inch minimum width Flanges riveted and soldered to Gutter.
- G. Secure Gutter to Roof Framing with Brackets spaced 4 ft. o.c., maximum. Shape Brackets to match Gutter profile.
- H. Provide Expansion Joints midway between Downspouts; overlap Gutter sections 2-1/2 inches and provide End Caps spaced 1/2 inch apart.
- I. Cover Expansion Joints tops with Loose-lock Cover; extend Cover over outer edge of Gutter, and embed in Sealant.
- J. Size Thimble slightly smaller than Downspout, and extend Thimble 2 inches below Gutter bottom.
- K. Rivet and solder Thimble flanges to Gutter bottom.

**PART 3 - EXECUTION**

**3.15 CONDUCTOR HEADS**

- A. Form of 24 ga. Galvanized Steel.
- B. Fabricate with riveted and Lap-soldered Seams.
- C. Extend Downspout Thimble 2 inches below Conductor Head bottom, shape Thimble to fit Downspout, and size slightly smaller than Downspout.
- D. Rivet and solder Thimble Flanges to Conductor Head bottom.
- E. Fabricate with Overflow Openings in face of Conductor Heads; locate below Roof flood line.
- F. Connect to Downspout Heads where Downspouts are adjacent to Wall Scuppers. Secure to Wall where and as shown on Drawings.

**3.16 DOWNSPOUTS**

- A. Form to detail of uncorrugated 24 ga. Galvanized Steel.
- B. Fabricate longitudinal joints with Double Corner Seams.
- C. Telescope upper into lower Sections 1-1/2 inches minimum, rivet and solder.
- D. At open Downspout ends provide elbow bends away from Building.
- E. Attach to Wall with 1-1/4 inch wide Straps matching downspout material, and 1 gage heavier.
- F. Locate Straps at Downspout tops, bottoms, horizontal joints, and 10 ft. maximum centers.
- G. Secure Straps to Wall with Fastener Heads covered with Strap-tabs.
- H. Except where otherwise shown on Drawings, install Downspouts plumb (modify Straps if necessary), and carefully align with Storm Drain Hub.
- I. Except where Downspouts are open-ended, extend Downspouts 3 inches minimum into Storm Drain Hub, and close opening with Plastic Transition Hub.

**3.17 ROOF PENETRATION FLASHING**

- A. General:
  - 1. Form of 24 ga. Galvanized Steel.
- B. Base Flashing:
  - 1. Extend Flange onto Roof 8 inches minimum in all directions away from Penetration and upward around Penetration to position at least 2 inches above Roof surface.
  - 2. At Sheetmetal Roofing fold upper and side edges at least 1/2 inch back over Flange.
  - 3. Solder-lap Joints.
  - 4. Furnish to Roofer for installation.
- C. Counter Flashing:
  - 1. Overlap Base Flashing at least 1 inch with Storm Collar sloped away from Penetration.
  - 2. Secure to Penetration with Solder or with Draw Band and Sealant.



**PART 3 - EXECUTION**

**3.18 EQUIPMENT SUPPORT FLASHING**

- A. Form of 18 ga. Galvanized Steel.
- B. Fully cap Support.
- C. Overlap Base Flashing 4 inches.
- D. Solder-lap Joints.
- E. Provide Sealant around Penetrations, if any.
- F. Provide at Roof-mounted Equipment.

**3.19 OPENINGS FLASHING**

- A. Provide 24 ga. Galvanized Steel Head, Jamb, and Sill Flashing around Doors, Windows, and other Openings in exterior Walls; where shown on Drawings; and elsewhere necessary to maintain Building watertight. Fabricate Horizontal Flashing with End Dams.

**3.20 WASTE MANAGEMENT**

- A. Collect and place Scraps, Pallets, and Packaging Waste where directed for recycling.

**3.21 CLEANING & REPAIRING**

- A. As Work progresses, neutralize excess flux with 5% to 10% Washing Soda Solution, and thoroughly rinse.
- B. Immediately after installation remove Protective Covering from Factory Painted Sheetmetal.
- C. 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.
- D. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Single-Ply Roofing: Sheetmetal Roofing: Section 07-61-00
- B. Sheetmetal Flashing: Section 07-62-00

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 DESIGN REQUIREMENTS**

- A. Design, engineer, and fabricate Hatches to support actual Dead Loads plus the following Design Loads:
  - 1. Minimum Design Loads: See Structural Notes on Drawings.
  - 2. Snow Drift Load: Comply with Building Code
  - 3. Horizontal & Uplift Wind Loads: Comply with Building Code
  - 4. Thermal Expansion & Contraction: Resistant to stress from 100°F temperature shift.

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.6 REGULATORY AGENCY REQUIREMENTS**

- A. Comply with OSHA Fall Protection Requirements.

**1.7 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show complete assembly including Curbs, Joints, Gaskets, Drainage, Insulation, Accessories, Anchorage, and other pertinent details.
- C. Include installation instructions.

**ROOF HATCHES****PART 1 - GENERAL****1.8 WARRANTY**

- A. Warrant Roof Hatch Work to be weatherproof for 2 years following Project Substantial Completion date, and repair and/or replace without additional cost to Owner any water leaks and resulting damage to Building Materials and/or Building Contents as may occur under normal usage within Warranty Period.

**PART 2 - PRODUCTS****2.1 ROOF ACCESS HATCH**

- A. Manufacturer: Babcock-Davis, Bilco, Dur-Red, Milcor, Nystrom, or approved.
- B. Series: Similar to Bilco Thermal Break
- C. Opening: Single leaf
- D. Size: \_\_\_\_\_ inches
- E. Minimum Thermal Resistance Rating (R): 20
- F. Finish:
1. Material: Manufacturer's standard baked-on Enamel
  2. Color: Selected after Contract award from Manufacturer's standard choices
- G. Required Accessories:
1. Watertight, insulated Curb.
  2. Shock-absorbing, spring-balanced, insulated Cover.
  3. Inside Closing Handle.
  4. Spring Latch with Inside and Outside Handles and Padlock Hasp.
  5. Hinges equipped with non-removable Pins.
  6. Telescoping Steel Tube extension mounted to Ladder top; Bilco Ladder Up, or approved.
  7. OSHA-compliant Hatch-opening Guard Rail including self-closing and latching Swinging Gate. Bilco Bil-Guard 2.0, or approved.
- H. Extent of Work: Provide where shown on Drawings.

**2.2 ROOF-MOUNTED EXPLOSION HATCH**

- A. Manufacturer: Gortler, or approved.
- B. Series: RHTX
- C. Type: Thermally-broken
- D. Opening Pressure: 100kg
- E. Opening: Single leaf
- F. Size: \_\_\_\_\_ inches

(Cont.)

**ROOF HATCHES****PART 2 - PRODUCTS****2.2 ROOF-MOUNTED EXPLOSION HATCH (Cont.)**

- G. Finish:
  - 1. Material: Manufacturer's standard baked-on Enamel
  - 2. Color: Selected after Contract award from Manufacturer's standard choices
- H. Required Accessories:
  - 1. Watertight, insulated Curb.
  - 2. Shock-absorbing, spring-balanced, insulated Cover.
  - 3. Inside Closing Handle.
- I. Extent of Work: Provide where shown on Drawings.

**2.3 PAINT PRIMER**

- A. For Galvanized Steel: Galvanized Primer as specified in Section 09-90-00
- B. For Aluminum: Zinc Chromate Primer as specified in Section 09-90-00

**2.4 ASPHALTIC COMPOUND**

- A. Manufacturing Standard: Fed. Spec. TT-C-494
- B. Type: II

**2.5 JOINT SEALANT**

- A. Material: Modified-Silicone type as specified in Section 07-92-00
- B. Extent of Work: Provide where necessary to produce weatherproof installation.

**PART 3 - EXECUTION****3.1 EXISTING CONDITIONS**

- A. Do not proceed until Surface to receive Hatch is secure, level, true, smooth, clean, dry, and prepared in accordance with approved Shop Drawings.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**PART 3 - EXECUTION**

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.
- B. Do not overload Roof with stored Materials.

**3.3 CORROSION PROTCTION**

- A. Protect contacting dissimilar Metals against galvanic corrosion with Asphaltic Compound, 7-1/2 mil thickness minimum, applied to each contacting face.

**3.4 INSTALLATION**

- A. Accurately secure Hatch plumb, level, true to line, without warp or rack, and in accordance with manufacturer's instructions and reviewed Shop Drawings.

**3.5 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.6 WASTE MANAGEMENT**

- A. Collect and place Scraps, Pallets, and Packaging Waste where directed for recycling.

**3.7 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 WORK INCLUDED**

- A. In accordance with governing laws, regulations, ordinances; and codes; and requirements specified in Section 01-11-50; seal Openings through Fire-rated Assemblies as required to prevent the passage or spread of Flame, Smoke, and Hot Gases, including the following:
  - 1. Piping, Ductwork, Cable, and Conduit passing through Fire-rated Walls, Floors, and Ceilings.
  - 2. Open Joints located between adjacent Fire-rated Walls, Floors, & Ceilings.
  - 3. Open Joints located between Exterior Walls and Floor edges.
  - 4. Open Cells between Steel Decking and adjacent Fire-rated Construction.

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Joint Sealants: Section 07-92-00

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 WORKER'S QUALIFICATIONS**

- A. Employed by or acceptable to Fire Stopping Manufacturer, with at least 2-years successful experience performing Work specified herein, and certified in compliance with FM 4991.
- B. Manufacturer's willingness to sell Firestopping Products to Applicator in itself does not establish Applicator's qualifications to perform Work..

**1.6 REGULATORY AGENCY REQUIREMENTS**

- A. Fire Stopping shall comply with governing Building Code requirements, including successfully passing Hose Stream Tests specified in IBC Sections 712 & 713.
- B. Minimum Fir-resistance Rating of Firestopping: Equal to or greater than Construction Assembly being penetrated.

**PART 1 - GENERAL**

**1.7 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.8 CERTIFICATE OF COMPLIANCE**

- A. Upon Work completion, submit Manufacturer's written certification that Fire Stopping has been installed in accordance with these Specifications and in compliance with Regulatory Agency Requirements.

**1.9 ADVANCE NOTICES**

- A. Upon Work completion, notify General Contactor to delay concealing Firestopping until Laboratory Testing specified in Section 01-45-30 has been satisfactorily completed.

**1.10 FIELD MOCK UP**

- A. Provide typical examples of each type of Fire Stopping for Architect's review.
- B. Reprepare, if necessary, until Mock Ups are accepted.
- C. Accepted Mock Ups represent minimum standard of acceptability, and Work of lesser quality is subject to rejection.
- D. Approved Mock Ups may be used on Project Work.

**1.11 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Deliver Products to Jobsite in original unopened Containers. Save Containers for Architect's inspection.
- B. Protect Products against damage or deterioration.
- C. Do not exceed Product "shelf life".
- D. Immediately remove from Project Site any damaged or out-of-date Products.

**1.12 ENVIRONMENTAL REQUIREMENTS**

- A. Perform no Work when Work Conditions exceed Fire Stopping Manufacturers' specified limits.

**FIRE STOPPING****PART 2 - PRODUCTS****2.1 FIRE STOPPING**

- A. Manufacturer: Firestop Systems, Hilti, Specified Technologies Inc., STI, 3M, or approved.
- B. Material: Free of Asbestos, Halogens, Lead, Flammable Solvents, Ethylene Glycol, or Volatile Solvents.
- C. Maximum VOC Emission: 250 g/l
- D. Types: Caulks, Wraps, Strips, Sheets, Mortars, Collars, Foams, Sprays, Mastics, Pillows, Pads, Boards, or Putties as required by conditions of use; compatible with adjacent Products; and obtained from single Manufacturer.
- E. Fire-resistiveness Certifications:
  - 1. At Penetrations through Fire-rated Walls & Ceilings: ASTM E-1966 or UL 2079
  - 2. In Joints between adjacent Fire-rated Walls & Ceilings: ASTM E-814 or UL 1479
- F. Performance Requirements: Fire Stopping shall be flexible, moisture resistant, and it shall not dissolve, re-emulsify, leach, break-down, deteriorate, shrink, or pull away from contact surfaces.
- G. Intumescent Products, if any, shall not contain Sodium Silicate or other water-soluble ingredients.
- H. Paintability: Fire Stopping, if and where exposed to view, shall be paintable or capable of receiving Finish Materials where so specified in other Sections.

**2.2 OTHER REQUIRED PRODUCTS**

- A. Collars, Cable Pathways, Grommets, Plugs, and other Devices necessary to prevent Fire or Smoke passage.

**PART 3 - EXECUTION****3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces to receive Fire Stopping are clean, dry, and free from Scale, Dust, Oil, Grease, Rust, Lacquer, loose Mortar, Laitance, Ice, Frost, or other Bond-reducing Matter.
- B. Allow Concrete Surfaces to cure at least 4 weeks before applying Sealant.
- C. Prior to starting Work, notify General Contractor about defects requiring correction.
- D. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.
- B. Mask Surfaces adjacent to Fire Stopping as required for protection.
- C. Do not remove adjacent Pipe Insulation.



**PART 3 - EXECUTION**

**3.3 SURFACE PREPARATION**

- A. Remove Dust, Dirt, Wax, Moisture, Ice, Frost, and any other Foreign Matter from Surfaces to receive Fire Stopping.
- B. If and where necessary, provide Backing Support to receive Fire Stopping.
- C. If and where so recommended by Fire Stopping Manufacturer, prime Surfaces to receive Fire Stopping. Follow Primer Manufacturer's instructions.

**3.4 FIRE STOPPING INSTALLATION**

- A. Follow Manufacturer's instructions and Building Code requirements.
- B. Fill Openings as required to ensure effective Fire and Smoke Barrier.
- C. Where necessary, provide Openings with Bond Breaker to prevent 3-sided Compound-adhesion.
- D. Trim excess Fire Stopping flush with adjacent Surface.
- E. Remove any Masking Materials.
- F. Leave exposed Surfaces neat and smooth.

**3.5 WARNING LABEL INSTALLATION**

- A. In any concealed Attic Areas, conspicuously locate and apply the following brightly colored Decals:
  - 1. On Fire Rated Walls, if any:
    - a. THIS WALL IS FIRE-RATED.  
CONTACT FACILITY OWNER  
PRIOR TO PENETRATING  
THIS WALL
  - 2. Adjacent to Firestop Devices, if any:
    - a. MAXIMUM CAPACITY OF THIS  
DEVICE IS \_\_\_ CABLES

**3.6 WASTE MANAGEMENT**

- A. Collect and place Scraps, Pallets, and Packaging Waste where directed for recycling.

**3.7 PRODUCT CLEANING & REPAIRING**

- 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. When removing spilled or excess Fire Stopping, do not damage adjacent Surfaces.
- C. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 EXTENT OF WORK**

- A. Caulk Exterior Joints as follows
1. Joints around Window Frames, Door Frames, and other Openings in Exterior Walls: Modified Silicone (STPe) Sealant
  2. Joints between Floor and bottom of Exterior Door Frames: Modified Silicone (STPe) Sealant
  3. Joints between adjacent Dissimilar Materials: Modified Silicone (STPe) Sealant
  4. Elsewhere caulking is shown on Drawings or required to weatherproof Building: Modified Silicone (STPe) Sealant
- B. Caulk within Exterior Frame Walls as follows:
1. Space between Wall Framing Members and Windows, Doors, and other Openings where subject to Air-infiltration: Foam Air-Infiltration Sealant
- C. Caulk Interior Joints as follows:
1. Joints around Window Frames, Door Frames, and other Openings in Exterior Walls: Acrylic Latex Sealant
  2. Joints between Resilient Flooring and Shower Receptacle: Modified Silicone (STPe) Sealant
  3. Joints between adjacent Dissimilar Materials: Acrylic Latex Sealant
  4. Elsewhere caulking is shown on Drawings or required to fill Open Joints: Acrylic Latex Sealant

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Sealing Sheetmetal Joints: Sections 07-61-00 & 07-62-00
- B. Sealant-type Firestopping: Section 07-84-00
- C. Glazing Compounds employed to set Glass: Section 08-80-00
- D. Acoustic Caulking at Metal Wall Framing: Section 09-10-00
- E. Acoustic Caulking at Gypsum Board: Section 09-25-00

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**PART 1 - GENERAL**

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.6 INSTALLER'S QUALIFICATIONS**

- A. Installer must have successfully completed at least 2 similar Projects, and be in full-time business performing Work of this type.

**1.7 FIELD MOCK UP**

- A. Provide examples of each type of Joint Sealant for Architect's review.
- B. Reprepare, if necessary, until Mock Up is accepted.
- C. Accepted Mock Ups represent minimum standard, and Work of lesser quality is subject to rejection.
- D. Approved Mock Ups may be used on Project Work.

**1.8 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.
- B. Store in original, tightly sealed Containers, and with original legible Labels thereon. Do not open Containers or remove Labels until Architect reviews.
- C. Do not exceed Sealant shelf life.

**1.9 WEATHER REQUIREMENTS**

- A. Perform no Work when weather exceeds Manufacturer's specified limits.
- B. Prohibited Air Temperature:
  - 1. Minimum: 40°F and falling
  - 2. Maximum: 90°F and rising

**1.10 WARRANTY**

- A. Warrant exterior Joint Sealant Work for 10 years following Project Substantial Completion date that Sealants will not loose their adhesion or cohesion, that Work of this Section will remain weatherproof, and that Contractor will repair and/or replace without additional cost to Owner any water leaks and resulting damage to Building Materials and/or Building Contents as may occur under normal usage within Warranty Period.

**PART 2 - PRODUCTS**

**2.1 MODIFIED SILICONE (STPe) SEALANT**

- A. Manufacturer & Brand: BASF Masterseal 150 (formally Sonneborn Sonolastic 150), or approved.
- B. Material: 1-component Silyl Terminated Polyester
- C. Manufacturing Standard: ASTM C-920, Type S, Class 25, Grade NS.
- D. ASTM C-661 Shore A Hardness Range: 15-20
- E. Joint Movement Range: Plus 100% to Minus 50%

**2.2 ACRYLIC LATEX SEALANT**

- A. Manufacturer & Brand: Contractor's choice
- B. Components: 1
- C. Manufacturing Standard: ASTM C-834
- D. Minimum ASTM C-736 Recovery: 75%
- E. Joint Movement Range: Plus or Minus 7½ %

**2.3 FOAM AIR-INFILTRATION SEALANT**

- A. Manufacturer Standard: AAMA 812

**2.4 SEALANT COLORS**

- A. Foam Sealant: Contractor's choice
- B. Modified Silicone Sealant: Clear Translucent, unless otherwise indicated.
- C. All Other: Approximate color of Adjacent Surfaces, unless otherwise indicated, and subject to Architect's approval. Obtain Architect's instructions if Sealant is adjacent to different colors.

**2.5 PRIMER & SURFACE CONDITIONER**

- A. Manufacturer & Type: Recommended by Sealant Manufacturer

(Cont.)

**PART 2 - PRODUCTS**

**2.6 BACKER ROD**

- A. Manufacturer & Brand: Contractor's choice
- B. Material: Combined open-cell & closed-cell Polyolefin, non-off gassing, non-exuding, non-absorbing, round, soft-rod, recommended by Sealant Manufacturer for conditions of use.
- C. Manufacturing Requirements: Comply with 1990 Clean Air Act.
- D. Diameter: 25% greater than Joint width
- E. Extent of Work: Provide for all Sealants, except Foamed types, where necessary to prevent 3-sided adhesion of Sealant to Substrate

**2.7 BOND-BREAKER TAPE**

- A. Manufacturer & Brand: Contractor's choice
- B. Material: Polyethylene Tape, or approved.
- C. Extent of Work: Where Backer Rod can not be used, provide Tape where necessary to prevent 3-sided adhesion of Sealant to Substrate

**2.8 FOAM SEALANT DAMS**

- A. Material: Contractor's choice
- B. Minimum UL Fire Resistance Rating:
  - 1. At Dams Remaining in Place: Match adjacent Wall or Floor Rating.
  - 2. At Dams to Be Removed: None required

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Joints to be sealed are clean, dry, and free from Dust, Oil, Grease, Rust, Lacquer, loose Mortar, Ice, Frost, or other Bond-reducing Matter. If necessary, remove Bond-reducing Matter by grinding.
- B. Verify that Sealants are compatible with Substrate.
- C. Allow Concrete Surfaces to cure at least 4 weeks before applying Sealant.
- D. Prior to starting Work, notify General Contractor about defects requiring correction.
- E. Do not start Work until conditions are satisfactory.

**PART 3 - EXECUTION**

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by work of this Section.
- B. Mask Surfaces adjacent to Joints as required for complete protection.

**3.3 SURFACE PREPARATION**

- A. Remove Dust, Dirt, Moisture, and any other Foreign Matter from Joints to be sealed.

**3.4 PRIMING**

- A. Unless otherwise recommended by Sealant Manufacturer, prime Surfaces to receive Sealant.
- B. Apply with Bristle Brush.
- C. Do not flood surfaces.

**3.5 INSTALLATION - GENERAL**

- A. Follow Manufacturers' instructions and ASTM C-1193.

**3.6 BACKER ROD INSTALLATION**

- A. Using dry Wheeled Tool, install Backer Rod behind Sealant in accordance with Sealant Manufacturer's instructions. Do not use Lubricants to ease installation.
- B. Provide in continuous, one-piece lengths where practicable. Where discontinuous pieces are necessary, butt Rod Joints neatly and snugly.
- C. At Corners, miter and snugly abut adjacent Rod ends.
- D. Depth behind adjacent Surface: Approximately 1/2 Joint width (*1/4 inch minimum and 5/8 inch maximum*).
- E. Do not stretch, twist, puncture, or tear Rods. Replace any damaged Rods.

**3.7 DAM INSTALLATION**

- A. Provide around Wall and Floor Penetrations to receive Foam Penetration Sealant.

(Cont.)

**PART 3 - EXECUTION**

**3.8 FOAM SEALANT INSTALLATION**

- A. Inject Sealant continuously until Opening is filled.
- B. If Opening is not filled within Sealant Snap Time or maximum of 3 minutes, stop application for at least 15 minutes before resuming work.
- C. Trim cured Foam flush with Adjacent Surface.
- D. Remove any combustible Dams.

**3.9 MODIFIED SILICONE (STPe) & ACRYLIC LATEX SEALANT INSTALLATION**

- A. Apply in accordance with Manufacturer's instructions using Hand or Pressure Gun-type Dispenser.
- B. Size Gun Nozzle to fit Joint.
- C. Force Sealant into Joints firmly against Joint Sides to fill Joints and Voids solid; superficial pointing with Skin Bead not acceptable.
- D. Prevent 3-sided adhesion of Sealant to Substrate.
- E. Install Sealant flush with Adjacent Surface.
- F. Within 10 minutes after installation, and using Dry Tool finish Sealant to smooth, uniform, and slightly concave shape.
- G. Remove excess Sealant and Masking Materials, if any, immediately after Sealant installation.
- H. Leave Sealant Surfaces neat and smooth.

**3.10 WASTE MANAGEMENT**

- A. Place used Sealant Tubes, Dispensers, and Pails in Hazardous Materials containers.
- B. Collect and place Scraps, Pallets, and Packaging Waste where directed for recycling.

**3.11 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Caulking Exterior Door Frames: Section 07-92-00
- B. Wood Doors: Section 08-21-00
- C. Steel Access Hatches: Section 08-30-00
- D. Aluminum Doors & Frames: Section 08-40-00
- E. Door Hardware: Section 08-71-00
- F. Glazing: Section 08-80-00
- G. Grouting Frames in Gypsum Board Walls: Section 09-25-00
- H. Field Painting: Section 09-90-00
- I. Electric Conduit & Wiring for Electric Door Strikes: See Electrical Specifications

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 REFERENCED SPECIFICATIONS**

- A. Except as modified herein, conform to the following Recommended Specifications published by Steel Door Inst.; 30200 Detroit Rd.; Cleveland, OH 44145-1967; (216) 892-1404.
  - 1. S.D.I. 100 Standard Steel Doors and Frames
  - 2. S.D.I. 105 Steel Frame Erection Instructions
  - 3. S.D.I. 107 Hardware on Steel Doors
  - 4. S.D.I. 117 Manufacturing Tolerances
  - 5. S.D.I. 118 Basic Fire Door Requirements
  - 6. A.N.S.I. A151.1 Acceptance Criteria for Steel Doors & Hardware Reinforcings.
  - 7. A.N.S.I. A224.1 Acceptance Criteria for Painted Surfaces
- B. Specifications can be obtained from Institute.

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.



**PART 1 - GENERAL**

**1.6 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show locations, elevations, principal construction features, and dimensions of each Door type and Frame type, cut-outs, reinforcement, joints, welds, finish, anchoring, and other pertinent details.
- C. Locate and detail Field Splice Joints for any Frames too large to ship in one piece. Indicate instructions for making Field Splices.
- D. Manufacturer's published details may be substituted for Standard Stock Items, provided required information is included.

**1.7 REGULATORY AGENCY REQUIREMENTS**

- A. Fabricate Doors and Frames, where scheduled to be Fire-resistive, in accordance with requirements of Underwriters Laboratories, Factory Mutual, or other Agency approved by Building Official. Affix Agency Acceptance Label on each piece.
- B. If and where Doors are required to be "Positive Pressure" type, accompany Code-compliance Installation Instructions with Door shipment.

**1.8 EVIDENCE OF COMPLIANCE**

- A. As defined in Referenced Specifications, affix Certifying Label on each Unit stating that Units conform to specified Regulatory Agency Requirements

**1.9 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.
- B. Remove Door Wrappings upon Jobsite delivery.
- C. Store Doors and Frames upright in protected dry area, at least 1 inch above Ground or Floor, and with at least 1/4 inch open-space between adjacent pieces.
- D. Brace bottom ends of Frame Jambs against displacement.

**1.10 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**PART 1 - GENERAL**

**1.11 SPECIAL WARRANTY**

- A. For 2 years following Substantial Completion date, and in accordance with Contract Conditions, warrant the following:
  - 1. Exterior installations against water-leakage
  - 2. Doors against delamination

**PART 2 - PRODUCTS**

**2.1 DOORS**

- A. SDI Model: 1 (Full flush, hollow, and with exposed Edge Seams only)
- B. SDI Grade: II (Heavy Duty)
- C. Minimum Metal Thickness: 18 ga.
- D. Core: 90 lb. minimum Phenolic Resin impregnated Honeycomb completely filling Core and bonded to both Face Skins.
- E. Sizes & Shapes: See Door Schedule and Drawings.

**2.2 FRAMES**

- A. Type: Head and Jamb Intersections mechanically-interlocked, and Frame Face mitered and welded.
- B. Minimum Metal Thickness: 16 ga.
- C. Sizes & Shapes: See Door Schedule and Drawings.

**2.3 FRAME ANCHORS**

- A. General: Follow Referenced Specifications
- B. To Floors: Provide Base Anchors at each Jamb.
- C. To Stud Walls:
  - 1. Full Frame width and depth, and welded to Frame.
  - 2. Minimum quantity:
    - a. Frames up to 7'-6" high: 4 per Jamb
    - b. Frames 7'-6" to 8'-0" high: 5 per Jamb
    - c. Frames higher than 8'-0": 5 Anchors plus 1 additional for each 2 ft. or fraction thereof over 8'-0"

**PART 2 - PRODUCTS**

**2.4 FABRICATION**

- A. Follow Referenced Specification.
- B. Accurately form Metal to required sizes and shapes.
- C. Bevel Lock-side Edge of Doors 1/8 inch in 2 inches. Square edged Doors not acceptable.
- D. Minimum Reinforcement Thickness:
  - 1. At Hinges: 8 ga.
  - 2. At Locks: 16 ga.
  - 3. At Surface Hardware: 12 ga.
  - 4. At Panic Devices: Fully reinforce. (*Thru-bolting not acceptable*)
- E. Assemble Components and grind and dress Welds to form smooth, flush surfaces, which do not show Weld or Fabrication Marks after painting when viewed from oblique angle. Do not use Metallic Fillers to conceal Defects.
- F. Fabricate with 26 ga. minimum Cover Boxes at Hardware Mortises.
- G. Provide High Frequency Reinforcement at top and bottom of Top Hinges.
- H. Weld Anchors to Door Frames.
- I. Fabricate with the following clearances:
  - 1. Between Doors and Frames: 1/8 inch
  - 2. Between Door Bottoms and Thresholds: 1/4 inch
  - 3. Between Door Bottoms and Floor: 3/4 inch
  - 4. Between Meeting Edges of pairs of Doors: 3/32 inch
- J. Prepare Door Frames to receive Silencers specified in Section 08-71-00.
- K. Hardware Mounting Heights: See Mounting Heights Drawing in Section 08-71-00.
- L. Fabricate Glazing Stops with butted Corner Joints.
- M. Glazing Stops shall not interfere with installation of any Flat Bar Panic Devices or any Lever Handle Door Latches or Locks.
- N. Fabricate any exterior, out-swinging Doors with flush tops.
- O. Fabricate Junction Boxes, Raceways, and Wiring necessary for Electrically-operated Hardware specified in Section 08-71-00.
- P. Fabricate any closed-section Mullions with internal Web Reinforcement.

**2.5 SHOP FINISH**

- A. Dress Surface irregularities to smooth surface.
- B. Chemically treat and clean exposed Surfaces.
- C. Treatment:
  - 1. Exterior Surface of Doors & Frames: Manufacturer's standard Rust Inhibiting Primer
  - 2. Interior Surface of Door Frames: Manufacturer's standard Waterproof Asphalt Compound

(Cont.)

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Openings to receive Hollow Steelwork are accurately sized and located, square, plumb, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. Follow Referenced Specifications and Manufacturer's instructions.
- B. Secure Anchors to Adjacent Construction.
- C. Set Frames true with Adjacent Construction.
- D. Accurately position Work.
- E. Set Doors flush with Frame face.
- F. Set Doors plumb to hold any desired position.
- G. Fill any exposed Fastener Heads, and finish to match adjacent Surface.

**3.4 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.5 WASTE MANAGEMENT**

- A. Collect and place Scraps and Packaging Waste where directed for recycling.

**3.6 PRODUCT CLEANING & REPAIRING**

- 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. Leave surfaces ready for Finish Painting specified in Section 09-90-00.
- C. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Custom Built Casework Doors: Section 06-41-00
- B. Hollow Steel Door Frames: Section 08-11-00
- C. Door Hardware: Section 08-71-00
- D. Door Glazing: Section 08-80-00
- E. Field Painting & Finishing: Section 09-90-00

**1.3 OPTIONS**

- A. Pre-fitting Doors to Frames and preparing for Door Hardware specified in Section 08-71-00 may, at Contractor's option, be performed at Factory.

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 REFERENCED SPECIFICATIONS**

- A. Architectural Standards published by Window & Door Manufacturing Assn., hereinafter referred to as WDMA.
- B. Standards can be obtained from Association at 401 N. Michigan Ave; Suite 2220; Chicago, IL 60611; (312) 321-6802.

**1.6 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

(Cont.)

**PART 1 - GENERAL**

**1.7 SHOP DRAWINGS**

- A. Submit as specified in Section 01-34-00.
- B. For each Door show Location, Size, Core material, Face material, required Undercuts, Blocking for Hardware, Openings together with full size Glass installation Mouldings, and Factory-machining for Hardware.

**1.8 SAMPLES**

- A. Submit as specified in Section 01-33-00.
- B. Include two 12x12 inch samples of Face Veneers complete with Factory-applied Finish.

**1.9 REGULATORY AGENCY REQUIREMENTS**

- A. Fabricate Doors, where scheduled to be Fire-resistive, in accordance with Underwriters Laboratories (UL) requirements. Affix UL Label to each Door.
- B. If and where Doors are required to be "Positive Pressure" type, accompany Code-compliance Installation Instructions with Door Shipment.

**1.10 PRODUCT DELIVERY**

- A. Do not deliver Doors to Jobsite until notified by General Contractor that Project is conditioned and prepared to handle and store Doors without damage or discoloration.
- B. Prior to delivery, factory-apply Manufacturer's standard Waterproof Sealer to Door Edges.
- C. Individually wrap each Door with Protective Covering. Upon Jobsite delivery, open Coverings to promote ventilation, however do not remove Covering until adjacent Painting and Finishing Work is completed.

**1.11 PRODUCT STORAGE & HANDLING**

- A. Protect against damage and discoloration.
- B. Do not store in damp or wet locations, including Spaces containing wet Materials.
- C. Store flat, at least 3-1/2 inches above level and dry surface, and in well-ventilated space.
- D. Protect Doors against direct Sunlight that could bleach Door Face Veneers.
- E. Handle Doors with clean Hands or clean Gloves.
- F. Do not drag Doors across other Doors or other Surfaces.

(Cont.)

**WOOD DOORS****PART 1 - GENERAL****1.12 STORAGE & WORK AREA ENVIRONMENTAL REQUIREMENTS**

- A. Humidity Range: 30% to 60%
- B. Air Temperature: 50°F to 90°F

**1.13 WARRANTY**

- A. Lifetime warranty required
- B. Replace, rehang, and refinish without additional cost to Owner any delaminated Doors or any Doors exceeding Tolerance limits.

**PART 2 - PRODUCTS****2.1 DOORS**

- A. Manufacturers: Algoma, Eggers, Graham, Lynden, Marshfield, Mohawk, Oregon Door, Vancouver, VT Industries, or approved.
- B. WDMA Manufacturing Standard: 1A
- C. WDMA Performance Grade: Heavy Duty
- D. WDMA Appearance Grade: Premium
- E. Type: Flush Face
- F. Construction: 5 ply
- G. Sizes: See Door Schedule
- H. Core:
  - 1. At Doors fire-rated for longer than 20 minutes: Manufacturer's standard non-combustible type without Asbestos.
  - 2. At all other Doors:
    - a. At Doors with Openings: Stile & Rail
    - b. Elsewhere: LD-2 grade Particle Board
- I. Face Veneer:
  - 1. Species: Maple
  - 2. Grain: Rift Sliced
  - 3. Veneer Match: Slip
- J. Head Rail Minimum Height: 8 inches
- K. Bottom Rail Minimum Height: 10 inches

(Cont.)

## **PART 2 - PRODUCTS**

### **2.1 DOORS (Cont.)**

- L. Edge Bands:
  - 1. At Doors fire-rated for longer than 20 minutes, if any:
    - a. Material: Door Manufacturer's standard Multiple-ply Laminate capable of improving Screw-holding capacity.
    - b. Provide Intumescent Material behind Edge Bands in compliance with IBC Section 71-5.-30 and label in compliance with NFPA 80.
  - 2. At All Other Doors:
    - a. Species: Manufacturer's standard Hardwood matching Door Veneer color.
    - b. Minimum Thickness: 1/2 inch
    - c. Extent of Work: Provide at Side Stiles only.

### **2.2 FABRICATION**

- A. Prepare Doors in accordance with Referenced Specifications.
- B. Bond Edge Banding to Core with Adhesive, and plane smooth before applying Face Veneers.
- C. At Paired Doors "pair match" Face Veneers on adjacent Door Faces and identify matching Faces.
- D. Fabricate any Fire-rated Doors with Inner Blocking which will permit secure Hardware installation without thru-bolting.
- E. Glazing Stops:
  - 1. In Fire-rated Doors, if any: Install with Manufacturer's standard Steel Stops installed with counter-sunk Screws.
  - 2. In Non-fire-rated Doors, if any: Install with Manufacturer's standard Wood Stops installed with counter-sunk Screws.
  - 3. Prevent Glazing Stops from interfering with installation of any Panic Devices or any Lever Handle Door Latches or Locks.
- F. Machine and hand sand exposed surfaces.
- G. Hardware Mounting Heights: See Mounting Heights Drawing in Section 08-71-00.

### **2.3 ALLOWABLE FABRICATION TOLERANCES**

- A. Thickness: 1/16 inch plus or minus.
- B. Size: 1/16 inch plus or minus; 1/32 inch for Factory-fit door.
- C. Squareness: 1/8 inch maximum difference between opposite diagonal measurements.
- D. Maximum Warp: 1/4 inch space measured from horizontal, vertical, or diagonal straight edge to point of maximum bow, cup, or twist.
- E. Maximum Stile, Rail, and Core telegraphing show-through at Door Face: 1/100 inch in any 3 inch span.



**WOOD DOORS****PART 2 - PRODUCTS****2.4 FACTORY-APPLIED FINISH**

- A. Finish: 1-coat Penetrating Stain followed by Satin-gloss Catalyzed Polyurethane
- B. Stain Color: See Color Schedule on Drawings.

**PART 3 - EXECUTION****3.1 EXISTING CONDITIONS**

- A. Verify that Door Frames are correct type, accurately located and sized, square, plumb, true, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 PREPARATION OF DOORS FOR HANGING**

- A. Undercut bottom edge of Doors where and as required for Floor Covering and Threshold clearances.
- B. Fitting Doors to Frames:
  - 1. At Non-fire-rated Doors: Fit for width by planing both sides of Door equally, and for height by sawing.
  - 2. At Fire-rated Doors: Fit for width by planing from lock-side only, and for height by sawing from bottom only.
  - 3. To prevent chipping, knife-cut Face Veneers before sawing.
- C. Seal job-cut surfaces with 2 coats of Waterproof Sealer compatible with Door Finish.

**3.4 HANGING**

- A. Position Doors flush with Frame face.
- B. Set plumb so that Door will hold any desired opening position.
- C. Install with the following Clearances:
  - 1. Between Door & Frame: 1/8 inch
  - 2. Between Door Bottom & Threshold: 1/4 inch
  - 3. Between Door Bottom & Floor: 1/4 inch
  - 4. Between Meeting Edges of pairs of Doors: 1/8 inch

**PART 3 - EXECUTION**

**3.5 ADJUSTMENTS**

- A. Adjust Doors to operate smoothly at time of Project Substantial Completion and during Warranty Period.

**3.6 WASTE MANAGEMENT**

- A. Collect and place Scraps and Packaging Waste where directed for recycling.

**3.7 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 PRODUCTS FURNISHED BUT INSTALLED AS WORK OF OTHER SECTIONS**

- A. Deliver Access Hatches to Gypsum Board Subcontractor for installation as specified in Section 09-25-00.

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Field Painting: Section 09-90-00

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.6 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show dimensions, fabrication details, required clearances, and Head and Jamb conditions.

**1.7 INSTALLER'S QUALIFICATIONS**

- A. Acceptable to Door Manufacturer.

**1.8 REGULATORY AGENCY REQUIREMENTS**

- A. Fabricate Hatches, where scheduled to be fire-resistive, in accordance with Underwriters Laboratories requirements. Affix UL Acceptance Label on each piece.

**PART 1 - GENERAL**

**1.9 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.

**PART 2 - PRODUCTS**

**2.1 ACCESS HATCHES**

- A. Manufacturer: Bilco, JL Industries, Miami-Carey, Milcor, Nystrom, or approved.
- B. Material: Steel
- C. Factory-applied Finish: Rust Inhibiting Primer specified in Section 09-90-00
- D. Mounting Method: Satisfy conditions of use
- E. Frame Flange: Exposed
- F. Sizes: See Drawings
- G. Minimum UL Fire Resistance Ratings: See Drawings
- H. Gasket Material: Flame-retardant Polyurethane
- I. Hinges: Concealed Pivot
- J. Locks: Screw Driver operated Cam
- K. Extent of Work: Provide where shown on Drawings.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Openings to receive Hatches are square, plumb, and accurately sized and located.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 CORROSION PROTECTION**

- A. Protect contacting Dissimilar Materials against Electrolytic Corrosion.

**PART 3 - EXECUTION**

**3.4 INSTALLATION**

- A. Install Work including Hardware in accordance with Manufacturer's instructions and approved Shop Drawings.
- B. Accurately locate and anchor Work plumb, square, true, rigid, secure, and with proper clearances.

**3.5 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.6 WASTE MANAGEMENT**

- A. Collect and place Scraps and Packaging Waste where directed for recycling.

**3.7 PRODUCT CLEANING & REPAIRING**

- 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. Leave surfaces ready for Painting specified in Section 09-90-00.
- C. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Vertical-lift Bi-fold Doors: Section 08-36-50
- B. Field Painting: Section 09-90-00
- C. Fused Disconnect Switch, Conduit and Wiring from Power Supply through Control Switches to operate Door-activator Motor: See Electrical Specifications

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 INSTALLER'S QUALIFICATIONS**

- A. Employed by or acceptable to Door Manufacturer.

**1.6 SHOP & INSTALLATION DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Indicate construction and installation details including Motor and Control locations, Counter Balances, Guides, Anchors, and required clearances.

**1.7 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage, rust, and discoloration.

(Cont.)

**PART 1 - GENERAL**

**1.8 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**1.9 SPECIAL WARRANTY**

- A. For 2 years following Substantial Completion date, warrant Doors against faulty operation and warrant exterior installations against water-leakage and air-infiltration.

**PART 2 - PRODUCTS**

**2.1 DOORS**

- A. Manufacturer: Crawford, Overhead, Wayne Dalton, or approved.
- B. Type: Thermally insulated
- C. Operation: Motorized
- D. Door Panel Material: Steel
- E. Finish: Specified below

**2.2 TRACK, COUNTERBALANCE, & OPERATING HARDWARE**

- A. Size & Type: Manufacturer's standard for conditions of use
- B. Rollers: Ball-bearing case-hardened Steel

**2.3 POWER OPERATOR**

- A. Size & Type: Manufacturer's standard for conditions of use
- B. Special Requirement: Doors easily operable during Power failure or Motor repair
- C. Operating Switches:
  - 1. Exterior: None required
  - 2. Interior: 3-button (Up/Stop/Down) instantaneous type not requiring continuous pressure to operate
  - 3. Location: See Drawings
- D. Protection Switch: Provide to instantly reverse downward Door movement should Obstruction interfere with Door travel.

**PART 2 - PRODUCTS**

**2.4 ACCESSORIES**

- A. Equip Doors with the following:
  - 1. Double-contact Door Bottom Weatherstripping.
  - 2. Track-mounted Spring Bumper to limit Door overrun.

**2.5 FINISHES**

- A. Tracks: Hot-dip galvanize in accordance with ASTM A-123
- B. Door Panels: Factory-apply Manufacturer's standard baked-on Enamel.
- C. Color: Selected by Architect after Contract award

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Openings to receive Doors are true, square, plumb, and accurately sized and located.
- B. Verify that Lighting Fixtures and other Equipment will not obstruct Door operations or vice versa.
- C. Prior to starting Work, notify General Contractor about defects requiring correction.
- D. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. Follow Manufacturer's instructions and approved Shop Drawings.

**3.4 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.



**PART 3 - EXECUTION**

**3.5 WASTE MANAGEMENT**

- A. Collect and place Scraps and Packaging Waste where directed for recycling.

**3.6 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion or sooner, if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Sectional Overhead Doors: Section 08-63-00
- B. Door Glazing: Section 08-80-00
- C. Fused Disconnect Switch, Conduit and Wiring from Power Supply through Control Switches to operate Door-activator Motor: See Electrical Specifications

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 INSTALLER'S QUALIFICATIONS**

- A. Employed by or acceptable to Door Manufacturer.

**1.6 SHOP & INSTALLATION DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Indicate construction and installation details including Motor and Control locations, Counter Balances, Guides, Anchors, and required clearances.

**1.7 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage, rust, and discoloration.

(Cont.)

**PART 1 - GENERAL**

**1.8 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**1.9 SPECIAL WARRANTY**

- A. For 2 years following Substantial Completion date, warrant Doors against faulty operation and warrant exterior installations against water-leakage and air-infiltration.

**PART 2 - PRODUCTS**

**2.1 DOORS**

- A. Manufacturer: Renlita Doors North America, or approved.
- B. Brand: S-3000 Foldaway Doors
- C. Type: 2-leaf, hinged, vertical-lift, stacking Overhead Doors
- D. Operation: Motorized
- E. Door Frame Material: Steel
- F. Finish: Specified below

**2.2 TRACK, COUNTERBALANCE, & OPERATING HARDWARE**

- A. Size & Type: Manufacturer's standard for conditions of use
- B. Rollers: Ball-bearing Nylon for quiet performance

**2.3 POWER OPERATOR**

- A. Size & Type: Manufacturer's standard for conditions of use
- B. Special Requirement: Doors easily operable during Power failure or Motor repair
- C. Operating Switches:
  - 1. Exterior: None required
  - 2. Interior: 1-button instantaneous type not requiring continuous pressure to operate
  - 3. Location: See Drawings
- D. Protection Switch: Provide to instantly reverse downward Door movement should Obstruction interfere with Door travel.

**PART 2 - PRODUCTS**

**2.4 ACCESSORIES**

- A. Equip Doors with the following:
  - 1. Double-contact Door Bottom Weatherstripping.
  - 2. Glazed Openings where shown on Drawings.
  - 3. Track-mounted Spring Bumper to limit Door overrun.

**2.5 FINISHES**

- A. Tracks: Hot-dip galvanize in accordance with ASTM A-123
- B. Door Panels: Factory-apply Manufacturer's standard baked-on Enamel.
- C. Color: Selected by Architect after Contract award

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Openings to receive Doors are true, square, plumb, and accurately sized and located.
- B. Verify that Lighting Fixtures and other Equipment will not obstruct Door operations or vice versa.
- C. Prior to starting Work, notify General Contractor about defects requiring correction.
- D. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. Follow Manufacturer's instructions and approved Shop Drawings.

**3.4 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**PART 3 - EXECUTION**

**3.5 WASTE MANAGEMENT**

- A. Collect and place Scraps and Packaging Waste where directed for recycling.

**3.6 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion or sooner, if directed.

**END OF SECTION**

**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 PRODUCTS INSTALLED, BUT FURNISHED UNDER OTHER SECTIONS**

- A. Door Hardware specified in Section 08-71-00.
- B. Glazing specified in Section 08-80-00

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Joint Caulking & Sealing: Section 07-92-00
- B. Hollow Steel Doors & Frames: Section 08-11-00
- C. Wood Doors: Section 08-21-00
- D. Electric Conduit & Wiring for Electric Door Strikes: See Electrical Specifications

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 REFERENCED SPECIFICATIONS**

- A. Comply with applicable portions of manufacturing and installation recommendations of American Architectural Manufacturer's Association, hereinafter referred to as AAMA; 1827 Walden Office Square; Suite 550; Schaumburg, IL 60173; (847) 303-5664.
- B. Copies can be obtained from Association.

**1.6 SYSTEM DESIGN REQUIREMENTS**

- A. In accordance with governing laws, regulations, and codes; and requirements specified in Section 01-11-50; design, engineer, fabricate, and install Work of this Section including System Supports & Attachments, in compliance with Drawings, Specifications, and the following Design Loads:
  - 1. Loads listed in Structural Notes on Drawings
  - 2. Wind Loads: Satisfy Building Code Exposure B requirements
  - 3. Maximum Surface Deflection:
    - a. Spans up to 14 ft.:  $L/240$
    - b. Spans 14 ft. & Greater:  $L/300$
    - c. Do not cause loss of Glass Bite greater than 25% of Design Dimension

**PART 1 - GENERAL**

**1.7 SYSTEM PERFORMANCE REQUIREMENTS**

- A. Design, engineer, fabricate, and install Work of this Section to satisfy the following:
  - 1. Withstand Thermal Expansion induced by up to 60°F Temperature Shift without System buckling, Glass stress, Sealant failure, Fastener damage, or other detrimental effects.
  - 2. Minimum AAMA 1502.7 Condensation Resistance Factor (CRF): 60
  - 3. AAMA System Water Penetration Field Test 501.2: No penetration

**1.8 CERTIFICATE OF COMPLIANCE**

- A. Submit certification, signed and sealed by Engineer registered to practice in Oregon, which stipulates that Work of this Section complies with Design & Performance Requirements specified above.
- B. If Work, as specified herein and shown on Drawings, is not capable of complying with Design & Performance Requirements specified above, so notify Architect at least 5 working days prior to Contract award.

**1.9 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.10 INSTALLER'S QUALIFICATIONS**

- A. Employed by or acceptable to Manufacturer.

**1.11 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show construction, materials, profiles, thicknesses, dimensions, fasteners, supports, anchors, required clearances, and other pertinent details.

**1.12 SAMPLES**

- A. Submit in accordance with Section 01-33-00.
- B. Include two 12 inch long Samples of specified Metal Finishes.
- C. Match fabricated Work with accepted Samples.

**PART 1 - GENERAL**

**1.13 PRODUCT DELIVERY**

- A. Coordinate with General Contractor's work schedule.

**1.14 PRODUCT STORAGE & HANDLING**

- A. Protect against damage and discoloration.

**1.15 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.  
B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**1.16 SPECIAL WARRANTY**

- A. For 2 years following Substantial Completion date, and in accordance with Contract Conditions, warrant exterior installations against water-leakage and air-infiltration, and to repair or replace without additional cost to Owner any water leaks and resulting damage to Building Materials and/or Building Contents as may occur under normal usage within Warranty Period.  
B. We, the undersigned, do hereby warrant for 10 years following project substantial completion, defective work as specified above, but not including any damage to Building Materials or Building Contents.

SYSTEM SUBCONTRACTOR: \_\_\_\_\_

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

GENERAL CONTRACTOR: \_\_\_\_\_

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

(Cont.)



**PART 2 - PRODUCTS**

**2.1 ALUMINUM**

- A. Alloys & Tempers, unless otherwise modified, as follows:
  - 1. Exposed Extrusions: 6063-T6
  - 2. Structural Shapes, Blocking, Bracing, & other Concealed Members: 06063-T6
  - 3. Casting: 214-T6
  - 4. Sheetmetal: 5005-H32
  - 5. Special Finishes: Modify Alloys and Tempers specified above as necessary for proper application of any Special Finishes specified hereunder.
- B. Finish:
  - 1. Concealed Work: Mill finish
  - 2. Exposed Work:
    - a. AAMA 611 Class 1
    - b. Anodic Color: \_\_\_\_\_
    - c. Minimum Coating Thickness: 0.7 mils

**2.2 STEEL REINFORCING**

- A. Manufacturing Standard: ASTM A-36

**2.3 FASTENERS**

- A. Type: Recommended by Manufacturer for conditions of use
- B. Material: Galvanically compatible with Adjacent Materials
- C. Finish:
  - 1. Where Exposed to View: Match Adjacent Material
  - 2. Where Concealed: Contractor's choice

**2.4 CORROSION INSULATING COMPOUND**

- A. Material: Asphaltic Coating Compound
- B. Manufacturing Standard: Fed. Spec. TT-C-494 type II

**2.5 DOOR FRAMES, WINDOW FRAMES, & WINDOW WALL FRAMES**

- A. Material: Aluminum
- B. Manufacturer: Arcadia, Kawneer, US Aluminum, Vistawall, or approved.
- C. Series: Match Kawneer \_\_\_\_\_

**PART 2 - PRODUCTS**

**2.6 DOORS**

- A. Material: Aluminum
- B. Manufacturer: Arcadia, Kawneer, US Aluminum, Vistawall, or approved.
- C. Series: 3-1/2 inches

**2.7 OPERATING SASH**

- A. Material: Aluminum
- B. Manufacturer: Arcadia, Kawneer, US Aluminum, Vistawall, or approved.
- C. Operation: See Drawings
- D. Insect Screens:
  - 1. Mesh Material: Fiberglass Wire Cloth
  - 2. Frame Material: Match Window Frame
  - 3. Coordinate with Window Operators.
  - 4. Extent of Work: Provide over all Operating Windows Sections.

**2.8 DOOR HARDWARE**

- A. See Section 08-71-00

**2.9 DOOR WEATHERSTRIPPING**

- A. Material: Flexible nonporous Polymeric Strip
- B. Features:
  - 1. All Weatherstripping: Easily replaceable
  - 2. Sill Weatherstripping: Easily adjustable for wear

**2.10 SASH WEATHERSTRIPPING**

- A. Material: Manufacturer's standard
- B. Maximum Allowable Air Infiltration: 0.5 cfm per lineal ft. of Operating Sash perimeter

**2.11 ACCESSORIES**

- A. Provide Attachment Embeds, Flashings, Break-metal Closures, Connectors, Trim, etc. necessary for complete, weatherproof, and secure installation.

**PART 2 - PRODUCTS**

**2.12 FABRICATION**

- A. Comply with applicable portions of Referenced Specifications.
- B. Hardware Mounting Heights: See Mounting Heights Drawing in Section 08-71-00.
- C. Provide concealed Steel Reinforcement where indicated or required to resist Wind or other Applied Loads.
- D. Fabricate Connections as required for strength and rigidity using concealed Mechanical Fastenings wherever possible. Where not possible, welding may be used.
- E. Drain Glazing Channels to prevent Insulating Glass from standing in Water.
- F. Fabricate with Weep Holes to evacuate to Building Exterior any exterior Water or interior Condensation.
- G. Cut Horizontal Members between Vertical Members.
- H. Match exposed Welds with adjacent Material, free of porosity, cracks, and blow-holes.
- I. Select Materials carefully for matching Color and Texture after finishing.
- J. Fabricate Flat Surface smooth and true, and free from waves, buckles, and seams.
- K. Fabricate Edges, Corners, and Angles clean, sharp, and square.
- L. Fit Members with hairline, virtually invisible joints.
- M. Allow for expansion and contraction.
- N. Prevent Noise resulting from thermally-induced Material movement, Vibration harmonics, or Wind passage.
- O. Make Exterior Work permanently weathertight.
- P. Fabricate with the following clearances:
  - 1. Between Doors & Frames: 1/8 inch
  - 2. Between Door Bottoms & Thresholds: 1/4 inch
  - 3. Between Door Bottoms & Floor: 3/4 inch
  - 4. Between Meeting Edges of pairs of Doors: 1/8 inch
- Q. Fabricate Junction Boxes, Raceways, and Wiring necessary for Electric Strikes specified in Section 08-71-00.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Openings to receive Work of this Section are plumb, rigid, accurately sized and located, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**PART 3 - EXECUTION**

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 CORROSION PROTECTION**

- A. Coat contacting Dissimilar Materials with Corrosion Insulating Compound, 7-1/2 mil dry film thickness, minimum, applied to each Contacting Face.

**3.4 INSTALLATION**

- A. Follow Manufacturer's instructions, approved Shop Drawings, and applicable portions of Referenced Specifications.
- B. Install plumb, square, true, rigid, secure, weather tight, and in alignment with adjacent Other Work.

**3.5 ALLOWABLE INSTALLATION TOLERANCES**

- A. Member Alignment:
  - 1. True within 1/8 inch per 12 feet.
- B. Openings:
  - 1. Accurately size and locate within 1/4 inch.
  - 2. Squareness: 1/8 inch maximum difference between opposite Diagonal Measurements.

**3.6 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.7 TOUCH-UP PAINTING**

- A. Touch-up any exposed Metal Finish damaged by cutting. Match adjacent Finish.

**3.8 WASTE MANAGEMENT**

- A. Collect and place Scraps and Packaging Waste where directed for recycling.

**PART 3 - EXECUTION**

**3.9 PRODUCT CLEANING & REPAIRING**

- A. Remove Protective Coatings.
- B. 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.
- C. Final Glass cleaning specified in Section 01-74-00.
- D. Remove Debris from Project Site upon work completion or sooner, if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Metal Roof Decking: Section 05-30-00
- B. Single-Ply Roofing: Section 07-53-00
- C. Sheetmetal Roofing: Section 07-61-00

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 DESIGN REQUIREMENTS**

- A. In accordance with governing laws, regulations, codes, and requirements specified in Section 01-11-50; design, engineer, and fabricate Assembly to support actual Dead Loads plus the following Minimum Loads:
  - 1. Minimum Design Loads: See Structural Notes on Drawings
  - 2. Snow Load: Comply with Building Code
  - 3. Horizontal & Uplift Wind Loads: Comply with Building Code
  - 4. Thermal Expansion & Contraction: Resistant to stress from 100°F temperature shift.
  - 5. ASTM E-330 Structural Performance at 150% of Design Load: No failure

**1.5 PERFORMANCE REQUIREMENTS**

- A. Minimum Light Transmission: 92%

**1.6 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

(Cont.)

**PART 1 - GENERAL**

**1.7 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show complete assembly including Curbs, Joints, Flashing, Drainage, Accessories, Anchorage, and other pertinent details.
- C. Include installation instructions.

**1.8 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.

**1.9 WARRANTY**

- A. For 5 years following Project Substantial Completion date, warrant Plastic Skylight Work to be weatherproof, and without additional cost to Owner, repair and/or replace Work causing water leaks as well as any resulting damage to Building Materials and/or Building Contents as may occur under normal usage within Warranty Period.

**PART 2 - PRODUCTS**

**2.1 SKYLIGHTS**

- A. Manufacturer: Naturalite, O'Keefe, Velux, Wasco, or approved.
- B. Shape: Rounded Dome
- C. Nominal Size: \_\_\_\_\_
- D. Frames: Factory assembled extruded Aluminum.
- E. Aluminum Finish:
  - 1. Concealed Surfaces: Mill finish
  - 2. Exposed Surfaces:
    - a. Manufacturer & Brand: Atochem Kynar 500, or approved.
    - b. Material: 2 coats Fluoropolymer Enamel
    - c. Color: White
- F. Dome Material: Acrylic Plastic conforming to Building Code Sect. 2603.
- G. Dome Type: Double ply, with clear transparent Outer Dome and white translucent Inner Dome.

(Cont.)

**PART 2 - PRODUCTS**

**2.2 DISSIMILAR MATERIAL ISOLATION COMPOUND**

- A. Manufacturer & Brand: 3-M Scotchwrap, or approved.
- B. Material: Black Vinyl
- C. Thickness: 10 mils

**2.3 FABRICATION**

- A. Provide Weep Holes to discharge Condensation and Infiltrated Water directly to outside.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Do not proceed until Surfaces to receive Skylights are secure, level, true, smooth, clean, dry, and prepared in accordance with approved Shop Drawings.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.
- B. Do not overload Roof with stored Materials.

**3.3 ISOLATING DISSIMILAR MATERIALS**

- A. Protect contacting dissimilar Metals against galvanic corrosion with Isolation Compound applied in accordance with Compound Manufacturer's instructions.

**3.4 INSTALLATION**

- A. Accurately secure true to line, without warp or rack, and in accordance with manufacturer's instructions and reviewed Shop Drawings.



**PART 3 - EXECUTION**

**3.5 WASTE MANAGEMENT**

- A. Collect and place Scraps and Packaging Waste where directed for recycling.

**3.6 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**PART 1 - GENERAL**

**1.1 CONTRACT CONDITIONS**

- A. Work of this Section is bound by the Contract Conditions and Division 1, 1, bound herewith, in addition to this Specification and accompanying Drawings.

**1.2 EXTENT OF WORK**

- A. Provide Wall Panels where shown on Drawings.

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Sheetmetal Flashing & Trim: Section 07620
- B. Plastic Skylights: Section 08620

**1.4 ALTERNATES**

- A. Refer to Section 01200 for possible effect upon Work of this Section.

**1.5 DESIGN REQUIREMENTS**

- A. In accordance with governing laws, regulations, codes, Design Loads listed in Structural Notes on Drawings, and requirements specified in Section 01115; design, engineer, and construct Assembly to support actual Dead Loads plus the following Design Loads:
  - 1. Minimum Live Load: See Structural Notes on Drawings
  - 2. Minimum Snow Drift Load: Comply with Building Code
  - 3. Horizontal & Uplift Wind Loads: Comply with Building Code
  - 4. Thermal Expansion & Contraction: Resistant to stress from 100°F temperature shift.
  - 5. Maximum ASTM E-72 System Deflection measured 5 minutes after release of 3.5 inch Short Term Deflection over 12 ft. Clear Span: 0.10 inch
  - 6. Maximum ASTM E-330 System Deflection when Fully Loaded: 1/100 of Span or 1 inch maximum.
  - 7. ASTM E-330 System Structural Performance at 150% of Design Load: No failure

**1.6 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**PART 1 - GENERAL**

**1.7 INSTALLER'S QUALIFICATIONS**

- A. Employed by or acceptable to Panel Manufacturer.
- B. Minimum Similar Experience: 5 years

**1.8 REGULATORY AGENCY REQUIREMENTS**

- A. Submit written certification by Independent Laboratory of compliance with IBC Requirements

**1.9 SHOP DRAWINGS**

- A. Submit in accordance with Section 01330.
- B. Include Panel layout, dimensions, required clearances, assembly, construction, anchorage, joinery, flashing, sealing, drainage, accessories, materials, finishes, and any other pertinent information.

**1.10 CERTIFICATE OF COMPLIANCE**

- A. Submit written affidavit, prepared and stamped by Engineer licensed to practice in Oregon, certifying that Assemblies will support Minimum Design Loads specified above and will provide for Assembly expansion and contraction.

**1.11 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.
- B. Store Panels under cover, above ground, and on long edge.
- C. Allow Air to circulate freely around and under Panels to prevent Condensation within Panels.
- D. Instruct General Contractor to not use Combustion type Heaters within proximity of Panels that could stain Panels.

**1.12 PREINSTALLATION CONFERENCE**

- A. Prior to starting Work, and in accordance with Section 01315, this Subcontractor shall arrange meeting to clarify any questions about Specifications, fabrication details, and installation requirements.
- B. Representatives of the following shall attend:
  - 1. General Contractor
  - 2. Sandwich Panel Subcontractor
  - 3. Roofing Subcontractor
  - 4. Sheetmetal Flashing Subcontractor

**PART 1 - GENERAL**

**1.13 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**1.14 WARRANTY**

- A. For 5 years following Project Substantial Completion date, warrant Translucent Sandwich Skylight Panel Work to be weatherproof, and without additional cost to Owner, repair and/or replace Work causing water leaks as well as any resulting damage to Building Materials and/or Building Contents as may occur under normal usage within Warranty Period.
- B. For 25 years following Project Substantial Completion Date, warrant Exterior Face Sheets against Fiber-exposure due to loss of Resin.

**PART 2 - PRODUCTS**

**2.1 SYSTEM MANUFACTURER**

- A. Kalwall, or approved.

**2.2 GLAZING PANELS**

- A. Thickness: 2-3/4 inches
- B. Pattern: Shoji
- C. "U" Factor when tested in accordance with National Fenestration Rating Council specification NFRC 100: 0.29
- D. Grid Core:
  - 1. Material: 6063-T6 Extruded Aluminum
  - 2. Grid Size: 12x24 inches
  - 3. Type: Mechanical-interlocked

(Cont.)

## **PART 2 - PRODUCTS**

### **2.2 GLAZING PANELS (Cont.)**

#### **E. Face Sheets:**

1. Material: Glass-fiber-reinforced, thermoset, full-thickness color-fast (without relying on Film or Coating) Resin designed for architectural use.
2. Type: Translucent
3. Thickness, plus or minus 10%:
  - a. Exterior Sheets: 0.070 inch
  - b. Interior Sheets: 0.045 inch
4. Color:
  - a. Exterior Sheets: Crystal
  - b. Interior Sheets: Crystal
5. Grade: Architectural
6. Exterior Sheet Weatherability:
  - a. Maximum ASTM D-2244 Delta E 5-year Color Change: 3.0 Units
  - b. Maximum ASTM D-2244 Delta L 2-week Darkening @ 150° F: 0.2 Units
7. Interior Sheet Flammability:
  - a. Maximum ASTM E-84 Flame Spread: 50
  - b. Maximum ASTM E-84 Smoke Development: 250
  - c. Maximum ASTM D-635 Burn Distance: 1 inch
  - d. Allowable Sheet Deformation, Deflection, or Drip when exposed to Fire or Flame: None
8. Protective Surface:
  - a. Material: Factory-applied, high-performance, self-cleaning thermo-set Acrylic Urethane
  - b. Minimum Thickness: 1.2 mils
  - c. Required Feature: Surface must be restorable in field.

### **2.3 SUPPORT SYSTEM**

- A. Shape: Vertical Wall
- B. Material: 6063-T5 & 6063-T6 Extruded Aluminum
- C. Aluminum Finish:
  1. Concealed Surfaces: Mill finish
  2. Exposed Exterior & Interior Surfaces: Dark Bronze anodic

### **2.4 REQUIRED ACCESSORIES**

- A. Flashing, Gutters, Condensate Weeps, and other Devices necessary for complete and weatherproof installation.

**PART 2 - PRODUCTS**

**2.5 SEALANT TAPE**

- A. Manufacturer & Type: Recommended by Panel Manufacturer

**2.6 SEALANTS**

- A. Manufacturer & Brand: Contractor's choice
- B. Type: Neutral-cure, non-hardening, and satisfying conditions of use.

**2.7 GALVANIC CORROSION PROTECTION MATERIAL**

- A. Material: Manufacturer's choice satisfying conditions of use.

**2.8 FASTENERS**

- A. Material: 300 series Stainless Steel
- B. Finished where exposed to View: Match adjacent exposed Framing Member.

**2.9 FABRICATION**

- A. Where possible, factory-fabricate and assemble Components into largest practicable sizes.
- B. Carefully fit exposed Members with hair-line, nearly invisible Joints.
- C. Provide Weep Holes to drain any Condensate Water or Intruded Water directly to Assembly exterior.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Do not proceed until:
  - 1. Structure and Surfaces to receive Panels are accurately sized and located, secure, true, smooth, clean, dry, sound, and otherwise properly prepared in accordance with approved Shop Drawings.
  - 2. Flashings are properly installed.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**PART 3 - EXECUTION**

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.
- B. Avoid overloading Building Structure with Stored Materials.
- C. Protect contacting Dissimilar Materials against Galvanic Corrosion with Galvanic Protection Paint, 7-1/2 mil minimum dry thickness, applied to each contacting face.

**3.3 PANEL INSTALLATION**

- A. Accurately locate and secure true to line, without warp or rack, and in accordance with Manufacturer's instructions and approved Shop Drawings.

**3.4 WASTE MANAGEMENT**

- A. Collect and place Scraps and Packaging Waste where directed for recycling.

**3.5 PRODUCT CLEANING & REPAIRING**

- 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. Remove Protective Materials, Identification Labels, and excess Sealant.
- C. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Hardware for the following Items:
1. Fence Gates: Section 02-83-00
  2. Roof Hatches: Section 07-72-00
  3. Access Hatches: Section 08-30-00
  4. Sectional Overhead Doors: Section 08-36-00
  5. Vertical-lift Bi-fold Doors: Section 08-36-50
  6. Toilet Compartments: Section 10-16-00
  7. Metal Lockers: Section 10-50-00
  8. Operable Partitions: Section 10-65-00
  9. Fire Extinguisher Cabinets: Section 10-99-00
  10. Manufactured Display Cases: Section 12-30-00
  11. Electrical Work to accommodate remotely-controlled Door Strikes, Delayed Egress Locking Systems, etc., if any: See Electrical Specifications
- B. The following items of Hardware:
1. Cabinet Hardware: Section 06-41-00
  2. Metal Toilet Accessories: Section 10-80-00

**1.3 PRODUCT SUBSTITUTIONS**

- A. Comply with requirements specified in Section 01-63-00.
- B. Include with Request: Specified Item, Design, Catalog Number, and Finish for each Item on which approval is being requested. Blanket approval by Manufacturer's Name only will not be given.

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.
- B. No later than 10 working days following Hardware Schedule acceptance, furnish Hardware Templates to Door and Frame Manufacturers.



**PART 1 - GENERAL**

**1.6 SUPPLIER'S HARDWARE SCHEDULE**

- A. Submit similar to Shop Drawings in accordance with Section 01-33-00.
- B. Organize into Hardware Sets, and indicate each Item, Opening, Door size, Door hand, Frame Material, Fire-resistance Label Rating, Keying, Material, Finish, and Manufacturer's Model Number.

**1.7 SUPPLIER'S REPRESENTATIVE**

- A. Hardware Supplier shall employ AHC-certified Consultant, who shall be available at reasonable times for consultation with Owner, Architect, and Contractor during course of Work.
- B. Supplier's Representative shall meet with Owner's Representative to prepare final Keying Schedule.
- C. Prior to Final Project Acceptance, Supplier's Representative shall:
  - 1. Make 1 field inspection and notify Architect if Hardware installation complies with Manufacturers' instructions and these Specifications.
  - 2. Instruct Owner how to properly adjust and maintain Hardware.

**1.8 REGULATORY AGENCY REQUIREMENTS**

- A. Conform to UL requirements for Fire-rated Openings.
- B. Conform to applicable requirements of Americans with Disabilities Act.

**1.9 CERTIFICATION OF COMPLIANCE**

- A. Prior to Substantial Completion, certify in writing that Hardware provided complies with these Specifications and approved Hardware Schedule.

**1.10 PRODUCT DELIVERY**

- A. Package each Item separately, and identify with Hardware Schedule Number.
- B. Deliver to General Contractor for installation, in original, unopened Containers with legible Labels intact.
- C. Include Manufacturers' Installation Instructions.
- D. Package Items individually in Manufacturers' original containers, complete with proper Fasteners and related Items. Clearly label Packages to indicate contents, Hardware Schedule Number, and Door Numbers.

(Cont.)

**PART 1 - GENERAL**

**1.10 PRODUCT DELIVERY (Cont.)**

- E. If necessary, include complete set of specialized Hardware Maintenance and Removal Tools for Owner's use. Store where directed by Owner.
- F. Ship tagged and identified Permanent Keys and Interchangeable Cores, if any, by Registered Mail to:
  - Craig Campbell
  - Oregon Manufacturing & Innovation Center
  - 33701 Charles T. Parker Way
  - Scappoose, OR 97056
- G. Ship Construction Keys directly to Contractor.

**1.11 PRODUCT STORAGE & HANDLING**

- A. Protect against theft, damage, and discoloration.

**1.12 FIELD MEASUREMENTS**

- A. Verify Door Openings and Field Measurements prior to fabrication.
- B. Modify Hardware where necessary to fit Door Opening.
- C. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**1.13 SPECIAL WARRANTY**

- A. Warrant the following, if any, against failure and faulty operation:
  - 1. Closers: 25 years
  - 2. Mortise Locks: 10 years
  - 3. Locksets: 10 years
  - 4. Exit Devices:
    - a. Mechanical Type: 10 years
    - b. Electrical Type: 2 years
  - 5. Other Hardware: 2 years

(Cont.)

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS, MODELS, SIZES, & FINISHES**

- A. See Schedule at end of Section.
- B. For each type of Hardware: Products shall be produced by single manufacturer, regardless of whether multiple manufacturers are specified.
- C. Lock Cylinders:
  - 1. Type: Tumbler
  - 2. Core: 6-pin
- D. Permanent Core Face Finish: Match adjacent Lock or Latch finish.
- E. Strike Lip: Curved and long enough to protect Door Frame Trim.
- F. Strike Box: Manufacturer's standard type
- G. Minimum Dead Bolt & Latch Bolt extension into Lock Case: 3/8 inch
- H. Lever Handles, if any, shall be solid and not hollow cavity.
- I. Lock backset-distance from adjacent Door Edge: 2-3/4 inches, unless otherwise required to accommodate any Weather-stripping or Gasketing
- J. Chassis: Cylindrical design, corrosion-resistant plated cold-rolled steel, through-bolted.
- K. Locking Spindle: Stainless steel, integrated spring, and spindle design.
- L. Latch Retractors: Forged steel, corrosion-resistant plated steel, or stainless steel.
- M. Latch bolt: Solid steel.
- N. Lever Trim: ADA-compliant design, independent operation, spring-cage supported, minimum 2 inches clearance from Lever mid-point to Door-face.

**2.2 HINGES**

- A. Type: Mortise

**2.3 DOOR SILENCERS**

- A. Manufacturer & Model: Ives SR64, or approved.
- B. Required Quantity per Door:
  - 1. At Doors Frames equipped with Gasketing or Weatherstripping: None
  - 2. Elsewhere:
    - a. At Frames for Single Doors: 3
    - b. At Frames for Paired Doors: 4

(Cont.)

**PART 2 - PRODUCTS**

**2.4 DOOR CLOSERS**

- A. Hydraulic Fluid at Exterior & Vestibule Doors: Consistent Viscosity within plus 120°F to minus 30°F Temperature Range
- B. Internal Pressure Relief Valves and Debris Screens: Not permitted
- C. At Positive Pressure Doors, if any: Comply with IBC Section 71-5.-30.7.
- D. Mounting Plates:
  - 1. At any Parallel Arm Closers: Soffit Plate Type
  - 2. Where Necessary: Drop type
  - 3. Elsewhere: Surface Shoe type
- E. Equip any Parallel Arm Closers with heavy-duty Arms.
- F. Fasteners: Concealed
- G. Hold-open Devices: Adjust to any predetermined angle within limit of Door swing.

**2.5 DOOR STOPS**

- A. In lieu of scheduled Wall Stops or Floor Stops, substitute Concealed Overhead Stays or Closers with Spring Stops, if and where:
  - 1. Stops create Pedestrian or Vehicle traffic hazard.
  - 2. 50%, or more, of Door width projects beyond point where Door contacts Door Stop.
  - 3. Wall Stops or Floor Stops are inappropriate.

**2.6 FLUSH BOLTS**

- A. Size: Follow ANSI and Steel Door Institute recommendations.
- B. Furnish any Floor Bolts with Dust-proof Strikes.
- C. Equip any U.L. approved Bolts with Positive Latching and Automatic Unlocking.

**2.7 EXTERIOR EMERGENCY BUILDING-ACCESS KEY-STORAGE BOX**

- A. Manufacturer: Knox Co., (800) 552-5669, or approved.
- B. Brand & Model: Knox-Box 1433
- C. Mounting: Surface
- D. Mounting Height above adjacent Ground Level: 5 ft.
- E. Mounting Location: Adjacent to following Building Entrances where located on Drawings:
  - 1. Main Building Entry
  - 2. South Shop Entry

**PART 2 - PRODUCTS**

**2.8 FASTENERS**

- A. Extent of Work: Provide all required
- B. Material & Finish: Match adjacent Hardware
- C. Types:
  - 1. If and where applied to Metal: Machine Screws and Bolts. Do not use Self-tapping Screws unless furnished by Frame Manufacturer.
  - 2. If and where applied to Wood: Full-thread Wood Screws
  - 3. If and where applied to Plywood or Particle Board: Sheetmetal Screws
  - 4. If and where applied to Concrete: Machine Screws with Expansion Shields
  - 5. Through-bolting: Not permitted, unless otherwise approved by Architect. Do not use Grommet Nuts, Sleeve Nuts or other such clamping-type Fasteners.
- D. Head Types:
  - 1. Where Exposed: Phillips
  - 2. Where Concealed: Contractor's choice

**2.9 DOOR KEYS**

- A. Material: Nickel-Silver, or approved.
- B. Cylinders & Cylinder Cores: Factory-keyed at Lock Manufacturer where permanent records are maintained. Locks and cylinders manufactured at same Factory.
- C. Construction Keying:
  - 1. Furnish Keys with Factory-keyed Construction Cylinders.
  - 2. Include 6 Construction Keys for Contractor's use.
  - 3. Following construction, Hardware Supplier shall convert Locks to Owner's permanent Keying System.
- D. Required Permanent Keys:
  - 1. Obtain the following Key quantities from Owner:
    - a. Change Keys for each Lock
    - b. Master Keys for each Master Key Set
    - c. Grand Master Keys
    - d. Key Blanks
- E. Stamping:
  - 1. On plain side of Keys, stamp "Do Not Duplicate".
  - 2. Do not stamp Master Keys with "M" or "Master".
  - 3. Do not stamp "Bitting Numbers" on Keys.

(Cont.)

**PART 2 - PRODUCTS**

**2.10 FABRICATION**

- A. Make Hardware for pre-fitted Doors and Frames to Template. Send Templates, together with Hardware Schedule, to Door and Frame Manufacturers no later than 2 weeks after Hardware Schedule approval.
- B. Lock and Latch Components shall be fabricated by only 1 Manufacturer, and carry that Manufacturer's Warranty.
- C. Cut and fit any Threshold or Floor Plates to Door Frame profile and with mitered Corner Joints. Where necessary weld Multiple Pieces together to form single Unit. Fabricate Joints with straight, smooth, and hair-line Seams.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces to receive Hardware are properly prepared, including necessary Backing.
- B. Verify that Electrical Rough-ins are correctly installed.
- C. Prior to starting Work, notify General Contractor about defects requiring correction.
- D. Do not start Work until conditions are satisfactory.

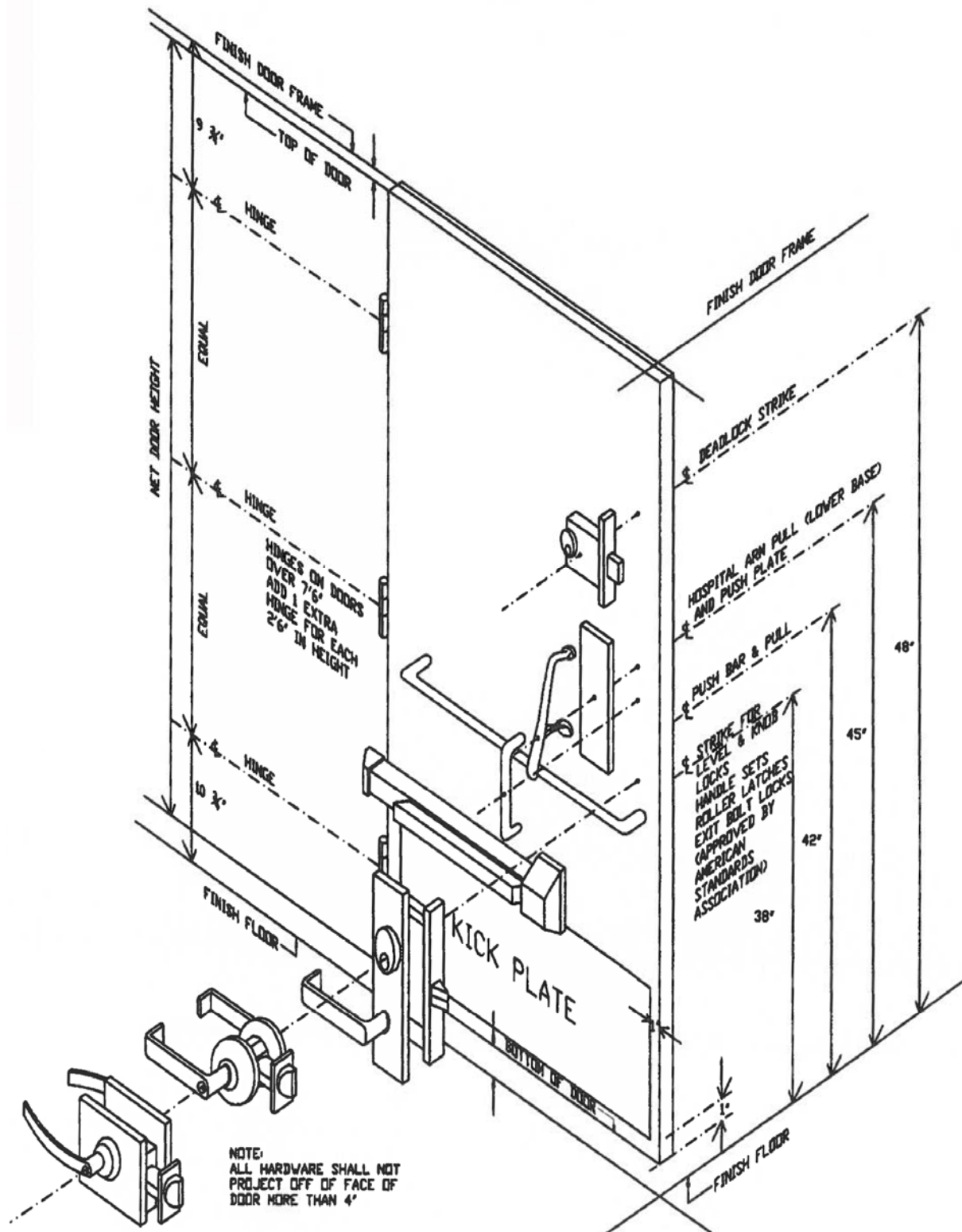
**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. Accurately locate, fit, and install square, plumb, and secure in accordance with Manufacturer's instructions and Templates.
- B. Mount Hardware at height shown on the following Mounting Heights Drawing.
- C. Locate any Roller Bumpers at Door top.
- D. Locate any Door Stops at Contact Point.
- E. Install any Kick Plates on push side of Door.
- F. Install Exterior Thresholds in full-bed of Exterior Sealant as specified in Section 07-92-00. Do not plug any Weep Holes. Remove any excess Sealant.
- G. Door Closer Mounting Locations:
  - 1. At Exterior Doors: On interior-side of Door
  - 2. At Vestibule Doors, if any: On Vestibule-side of Door
  - 3. At Corridors: On Room-side of Door
  - 4. Unless specifically specified elsewhere, do not restrict Door swing.
- H. After fitting any Mortised Hardware to Surfaces to be painted, remove and store Hardware in Original Package until Painting completion, then permanently install.

**FINISH HARDWARE MOUNTING HEIGHTS**



**PART 3 - EXECUTION**

**3.4 ADJUSTMENTS**

- A. At time of Project Substantial Completion and during Warranty Period, test, adjust, and where necessary, using Fine Powdered Graphite, lubricate Locks, Latches, other Moving Parts including Lock Keyways, and Gaskets for smooth and easy operation.
- B. After Building Ventilation System has been balanced, Supplier's Representative shall test and adjust Door Closers for:
  - 1. Complete, silent, and smooth operation.
  - 2. Compliance with the following:
    - a. Maximum Closing Time from 70° open to 3 inches from Latch: 5 seconds
    - b. Maximum Required Door Opening Force (excluding unlatching force):
      - 1. Fire-rated Doors: Least possible Force to close and latch Door
      - 2. Non-fire-rated Exterior & Interior Doors: 5 lbs.
- C. Conduct Tests as follows:
  - 1. Equipment: Calibrated Push/Pull Scale
  - 2. Method: Apply Testing-Force perpendicular to Door at Door Lock/Latch or 30 inches from Hinge-edge of Door, whichever is farther from Hinge.
  - 3. Frequency: Repeat Tests at least 3 times to assure that Test results do not vary widely.
  - 4. Record: Submit written Test Record for Architect's review and approval.

**3.5 WASTE MANAGEMENT**

- A. Collect and place Scraps and Packaging Waste where directed for recycling.

**3.6 PRODUCT CLEANING & REPAIRING**

- A. Remove temporary Protective Coverings from Hardware.
- B. 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.
- C. Remove Debris from Project Site upon Work completion, or sooner if directed.

**3.7 HARDWARE SCHEDULE**

**END OF SECTION**



**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Hollow Steel Doors & Frames: Section 08-11-00
- B. Wood Doors: Section 08-21-00
- C. Aluminum Entrance & Window Wall Systems: Section 08-40-00
- D. Vertical-lift Bi-fold Overhead Doors: Section 08-36-50
- E. Fire Extinguisher Cabinet Glazing: Section 10-99-00
- F. Glass Display Cases: Section 12-30-00

**1.3 OPTIONS**

- A. Contractor may, at Contractor's option, install Glazing in Field or in Factory.

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 REFERENCED SPECIFICATION**

- A. Comply with applicable portions of:
  - 1. Glazing Manual published by Flat Glass Marketing Association, hereinafter referred to as FGMA; White Lakes Professional Bldg.; 3310 Harrison; Topeka, Kansas 66611; (913) 266-7013.
  - 2. Insulating Glass manufacturing and installation recommendations of Sealed Insulating Glass Mfrs. Assn, hereinafter referred to as SIGMA; 111 E. Wacker Dr.; Chicago, IL 60610; (312) 644-6610.
- B. Copies can be obtained from Associations.

**1.6 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**GLAZING****PART 1 - GENERAL****1.7 REGULATORY AGENCY REQUIREMENTS**

- A. Comply with Safety Glazing requirements of IBC Section 24-06-.0

**1.8 PRODUCT DELIVERY**

- A. Schedule to coincide with glazing schedule.
- B. For each piece of Glass affix Label identifying the following:
1. Glass Manufacturer, quality, and thickness.
  2. On Low-E type Insulating Glass identify Glass "U" Factor, Shading Coefficient, and Light Transmission Ratings as certified by National Fenestration Rating Council (NFRC).
- C. Where Labels must be removed for Glass cutting, save Labels for Architect's review.
- D. Deliver other Glazing Materials in Original Containers with Manufacturer's original legible Labels thereon.

**1.9 PRODUCT STORAGE & HANDLING**

- A. Protect against damage and discoloration.
- B. Prevent Glass to Glass contact.
- C. Do not overload Structure with stored Materials.
- D. Store crated Glass in cool, dry, shady, well ventilated area, which is not subject to Sun, Rain, or other Elements.
- E. Block Crates 2 to 6 inches above Floor.
- F. Secure Crates against accidental overturning.
- G. Cover Crates with Waterproof Plastic or Canvas. Maintain sufficient air circulation under Cover to prevent Condensation within Crates.

**1.10 ENVIRONMENTAL CONDITIONS**

- A. Do no glazing when:
1. Air Temperature is below 40°F.
  2. Sufficient Dust is present that could impair Glazing Compound adhesion.
  3. During Wet Weather except under Cover.

**1.11 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**PART 1 - GENERAL**

**1.12 EXTENDED WARRANTIES**

- A. In accordance with Supplementary Conditions, Section 00-80-00, provide the following Extended Warranties:
1. Exterior Glazing against Air and Water Infiltration: 2 years
  2. Insulating Glass against Edge Seal or other Failures, including Dust, Moisture, or Film on Interior Surface of Glass: 10 years (*Note: Failed Units shall be replaced and not repaired.*)
  3. Mirrors against De-silvering, Discoloring, Black Spots, or Clouding of Silver Film: 5 years
  4. Spontaneous in-place Glass-breakage as follows:
    - a. Warranty Period: 5 years
    - b. Replace Broken Panels at no additional cost to Owner.
    - c. Warranty includes Glass-replacement plus any consequential damage to Building Materials or Building Contents, and any consequential medical expenses incurred by personal injury to Building Occupants.

**PART 2 - PRODUCTS**

**2.1 APPROVED GLASS MANUFACTURERS**

- A. AFG Industries, hereinafter called AFG
- B. AHC Float Glass Operations, hereinafter called AHC
- C. Cardinal Glass, hereinafter called CG.
- D. Ford Glass, hereinafter called FG.
- E. Guardian Glass, hereinafter called GG.
- F. Libbey, Owens, Ford, hereinafter called LOF.
- G. Pilkington North American, hereinafter called PLK
- H. Pittsburgh Plate Glass (Now known as Vitro), hereinafter called PPG.
- I. Saint-Gobain Glass, hereinafter called SG.
- J. Vitro Architectural Glass (formally PPG Glass), hereinafter called VIT
- K. Other Manufacturers may be approved by request in accordance with Section 01-63-00.

**2.2 GLASS-GENERAL**

- A. Color & Pattern: All Glass shall be clear and smooth, unless otherwise specified herein.
- B. Thickness: Follow Building Code requirements.

**GLAZING****PART 2 - PRODUCTS****2.3 FLOAT GLASS**

- A. Approved Manufacturers: AFG, AHC, FG, GG, LOF, PLK, SG, VIT, or approved.
- B. Manufacturing Standard: ASTM C-1036
- C. Quality: Glazing Select

**2.4 LAMINATED EXPLOSION-RESISTANCE GLASS**

- A. Manufacturing Standard: US General Services Administration (GSA) Level D

**2.5 OBSCURE GLASS (Base Bid)**

- A. Manufacturer: FG, GG, LOF, PLK, SG, VIT, or approved.
- B. Pattern: Similar to GG type P516

**2.6 ELECTRONICALLY-CONTROLLED PRIVACY GLASS (Alternate Bid)**

- A. Manufacturer: Polytronix, or approved.
- B. Brand: Polyvision
- C. Color: Clear
- D. Thickness: Satisfy conditions of use.
- E. Minimal Optical Transparency: 75%
- F. Control Switch Location: See Drawings

**2.7 WIRELESS FIRE-RATED SAFETY GLASS**

- A. Manufacturer & Brand: Interedge Pyrobel, PLK Pyrostop, Schott Pyran, SG Vetrotech Swissflam, Technical Glass Products FireLite Plus, or approved.
- B. Glass Type: Clear Transparent
- C. Minimum Impact Safety Rating: CPSC 16CFR1201 (Level II)
- D. Minimum UL Fire-resistance Rating: 120 minutes
- E. Label: Permanently imprint Glass with Safety Rating & Fire Resistance Rating

**2.8 TEMPERED GLASS**

- A. Manufacturing Standard: ASTM C-1048
- B. Safety Performance Standard: CPSC 16-CFR-1201-C11
- C. Glass Type & Thickness: As specified above
- D. Extent of Work: See Glazing Schedule at end of Section.

**GLAZING****PART 2 - PRODUCTS****2.9 THERMAL INSULATING GLASS**

- A. Approved Manufacturers: AFG, AHC, FG, GG, LOF, PLK, SG, VIT, or approved.
- B. Brand: Similar to VIT Solarban 70XL Clear+Clear
- C. Manufacturing Standard: SIGMA CBA
- D. Edge Material: Sealant conforming to ASTM E-6-P3
- E. Assembly Type: Soft Coat Low-E (Vacuum Deposition) on Surface #2
- F. National Fenestration Rating Council (NFRC) Certified Performance Requirements:
  - 1. Maximum Summer "U" Value: 0.26
  - 2. Maximum Winter "U" Value: 0.28 0.
  - 3. Maximum Shading Coefficient: 0.32
  - 4. Maximum Solar Heat Gain Coefficient: 0.27
  - 5. Minimum Light Transmission: 64%
- G. Glass Layers: 2
- H. Overall Thickness: 1 inch
- I. Glass Type:
  - 1. Exterior Sheet: Clear Float Glass
  - 2. Interior Sheet: Clear Float Glass

**2.10 SETTING BLOCKS**

- A. Material: EPDM or Neoprene Rubber, unless otherwise required for compatibility with Glazing Compound and Sealant.
- B. Shore A Durometer Hardness: 80-90
- C. Width: 1/8 inch wider than Glass Unit to be supported and 1/16 to 1/8 inch narrower than Glazing Pocket
- D. Length: Sufficient to support Glass Unit without excessive pressure on Glass edge

**2.11 GLAZING COMPOUND**

- A. Manufacturer: Dow, Gibson-Homans, Momentive Performance Materials (*formerly GE Advanced Materials*), 3-M, Sonneborn, Tremco, or approved.
- B. Material:
  - 1. For Insulating Glass:
    - a. Compatible with Glass Edge Sealant and recommended by Insulating Glass Fabricator for conditions of use.
  - 2. For Factory-glazed Units:
    - a. Unit Manufacturer's standard Glazing Compound
  - 3. For Field-glazed Units:
    - a. At Hollow Steelwork: Closed Cell Tape Bedding with Silicone Compound
    - b. At Aluminum Entrance & Window Wall Sections: Neoprene or Vinyl Extruded Bead recommended by Section Manufacturer
    - c. At Woodwork: Closed Cell Tape Bedding with Acrylic Latex Compound

**GLAZING****PART 2 - PRODUCTS****2.12 MIRRORS**

- A. Mirror Glass:
  - 1. Glass Type: Float
  - 2. Glass Thickness: 1/4 inch
  - 3. Quality: No. 1
  - 4. Silvering: Standard
  - 5. Backing: Copper protected by Paint or Varnish
  - 6. Glass Edges at unframed Mirrors, if any: Ground & Polished
- B. Back Covering where Metal Frames are specified: Painted Steel or Hardboard
- C. Metal Frame:
  - 1. Material: Extruded Aluminum
  - 2. Finish: Anodic
  - 3. Color: Natural
  - 4. Approximate Face Width: 1/2 inch
  - 5. Corners: Square and mitered
- D. Size: See Drawings

**PART 3 - EXECUTION****3.1 EXISTING CONDITIONS**

- A. Verify that Openings to be glazed are accurately sized, shaped and located, and free of Fasteners and other Projections which will interfere with glazing.
- B. Verify that Weep System is open.
- C. Verify that Glazing Surfaces are free of Moisture, Dirt, Grease, Oil, or other Deleterious Material.
- D. Verify that any Steel or Wood Glazing Rabbets and any contacting Dissimilar Materials are painted.
- E. Verify that Surfaces to receive Mirrors are structurally sound and capable of supporting Mirrors.
- F. Prior to starting Work, notify General Contractor about defects requiring correction.
- G. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**GLAZING****PART 3 - EXECUTION****3.3 PREPARATION WORK**

- A. Prior to glazing, clean, dry, and remove any Protective Coatings from Glass and from Surfaces to be glazed.
- B. Grind and polish exposed Mirror edges.
- C. Clean inside faces of Double-glazed Openings before setting Glass in place.
- D. Tape Laminated Glass edges before setting.

**3.4 GLASS INSTALLATION**

- A. General:
  - 1. Follow Referenced Specifications and Manufacturer's instructions.
  - 2. Allow for Glass expansion and contraction.
  - 3. Do not impact Glass against Framing.
  - 4. Install Glass with Setting Blocks placed at Sill quarter points.
  - 5. Do not set any Glass Flares or Bevels adjacent to Setting Blocks.
  - 6. Install any Glass Surface Waves running horizontal.
  - 7. Shift Glass with Suction Cups; do not use Pry Bar.
  - 8. Remove Identity Labels immediately after installation; save for Architect's review.
- B. Tempered Glass:
- C. Take particular care to prevent Glass-edge damage.
- D. Laminated Safety Glass:
  - 1. Do not expose Glass edge to Moisture, Organic Solvents, or Glazing Compounds containing such Solvents.
- E. Obscure Glass:
- F. Install Patterned Face toward Building interior.
- G. Thermal Insulating Glass:
  - 1. Follow Glazing Specification for Sealed Insulating Glass Units, SIGMA No. 70-7-1.

**3.5 MIRROR INSTALLATION**

- A. Install Mirrors plumb, level, after Finish Painting is completed, and with open Ventilation Space behind Mirror.
- B. Secure to Backing with concealed Mechanical Fasteners, where possible, or with Adhesive which will not damage Mirror Silvering.

(Cont.)

**GLAZING****PART 3 - EXECUTION****3.6 PRODUCT CLEANING & REPAIRING**

- A. Remove excess Glazing Compound from Glazing and adjacent Surfaces.
- B. Final Glass Cleaning: Specified in Section 01-74-00.
- C. Remove Debris from Project Site upon Work completion, or sooner if directed.
- D. 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.

**3.7 WASTE MANAGEMENT**

- A. In accordance with Section 01-64-00:
  - 1. Glass Waste: Separate by type and color for reuse or recycling.
  - 2. Metal & Cardboard Waste: Collect and place where directed for recycling.

**3.8 PROTECTING COMPLETED WORK**

- A. Protect installed Glazing against breakage and staining.
- B. Identify Glazed Areas with Streamers or other suitable Warning Placard.
- C. Notify General Contractor to prohibit Material storage close enough to Glass to create sufficient Heat Trap to cause Glass breakage.

**3.9 GLAZING SCHEDULE**

- A. Provide specified Glass in the following locations:
  - 1. Exterior Glazing: Clear Insulating Glass
  - 2. Interior Glazing:
    - a. In Doors & Windows located in Fire-rated Corridors: Fire-rated Safety Glass
    - b. Where located on Drawings: Mirrors
    - c. Where located on Drawings: Obscure Glass
    - d. Where located on Drawings: Laminated Explosion-resistant Glass
    - e. Where located on Drawings: Electronically-controlled Privacy Glass
    - f. Elsewhere: Clear Float Glass
- B. Except at Laminated Explosion-resistant Glass, temper any Exterior or Interior Glass where so stipulated by Building Code Sec. 2406, and elsewhere shown on Drawings or Schedules.

**END OF SECTION**



**NON-STRUCTURAL STEEL WALL FRAMING & CEILING SUSPENSION SYSTEMS****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 EXTENT OF WORK**

- A. Non-axially-loaded Wall Framing and Ceiling Framing to receive Gypsum Board.

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Gypsum Board: Section 09-25-00
- B. Metal Suspension System for Acoustic Tile: Section 09-50-00

**1.4 OPTIONS**

- A. Contractor may, at Contractor's option, substitute Drywall Ceiling Suspension Systems by Armstrong, Donn, USG, or approved, in lieu of Ceiling Suspension System specified herein.

**1.5 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon work of this Section.

**1.6 REFERENCED SPECIFICATIONS**

- A. General:
  - 1. Conform to Referenced Specifications hereinafter named, as Architect judges them applicable, and as modified and supplemented herein.
  - 2. Recommended materials and methods are mandatory; those proposed as equivalent by Contractor must be accepted by Architect.
- B. Metal Framing and Furring for Gypsum Board.
  - 1. Installation of Steel Framing Members to receive Screw-attached Gypsum Wallboard, Backing Board, or Water-resistant Backing Board; ASTM C-754.
- C. Exceptions:
  - 1. Provide Items not covered by above Standards, or herein, in accordance with Manufacturer's instructions.

**NON-STRUCTURAL STEEL WALL FRAMING & CEILING SUSPENSION SYSTEMS****PART 1 - GENERAL****1.7 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.8 BUILDING CODE**

- A. If and where Fire-rated Partitions or Ceilings are required, construct to obtain Code-required Rating.
- B. Prior to starting Work submit certification to Architect that Ceiling System complies with Seismic Loading requirements of Building Code, and that System is acceptable to Building Official.

**1.9 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect Metal Materials against rust and other damage.
- B. Do not distort Members.
- C. Do not overload Structure with stored Products.

**PART 2 - PRODUCTS****2.1 MANUFACTURERS**

- A. Cemco, ClarkWestern Dietrich, Scafco, Steeler, Steel Systems, Western, or approved.

**2.2 WALL FRAMING STUDS**

- A. Material: Steel
- B. Manufacturing Standard: ASTM C-645
- C. Shape: Channel
- D. Size: See Drawings
- E. Metal Finish: Galvanize in accordance with ASTM A-653 class G-40
- F. Minimum Metal Thickness, unless otherwise indicated on Drawings:
  - 1. At Double Studs adjacent to Door Jambs: 20 ga. (0.0296 inch)
  - 2. At Studs supporting any Plumbing Fixtures or other Wall-hung Items: 20 ga. (0.0296 inch)
  - 3. At Studs taller than 12 ft.: 20 ga. (0.0296 inch)
  - 4. Elsewhere: 25 ga. (0.0179 inch)
- G. Required Accessories: Runner Track and other Devices necessary for complete installation.

**NON-STRUCTURAL STEEL WALL FRAMING & CEILING SUSPENSION SYSTEMS****PART 2 - PRODUCTS****2.3 FRAMING & FURRING CHANNELS**

- A. Material: Steel
- B. Manufacturing Standard: ASTM C-645 Class B
- C. Size: See Referenced Specifications
- D. Shape: Channel
- E. Metal Finish: Electro-galvanize in accordance with ASTM A-591 class B

**2.4 FURRING ACCESSORIES**

- A. Type: Contractor's choice
- B. Provide as indicated or required for complete installation.

**2.5 WIRE**

- A. Material: Galvanized Steel Wire
- B. Manufacturing Standard: Fed. Spec. QQ-W-461
- C. Minimum Wire Size:
  - 1. For Tying: 16 ga.
  - 2. For Hanging: 9 ga.

**2.6 FASTENERS & ATTACHMENT DEVICES**

- A. Manufacturer: Made or recommended by Accessory Manufacturer.
- B. Manufacturing Standard: ASTM C-1002
- C. Provide all required for complete installation.

**2.7 SILL SEALER**

- A. Manufacturer: Owens-Corning Sill Sealer, or approved.
- B. Material: Fiberglass
- C. Thickness: 3/16 inch
- D. Width: Match Sill Plate
- E. Extent of Work: Provide under any Exterior Wall Sill Plates.

**2.8 ACOUSTIC SEALANT**

- A. Manufacturer & Brand: Pecora BA 98, Tremco Acoustic Sealant, U.S. Gypsum Acoustic Sealant, or approved.
- B. Extent of Work: Provide at Sound-attenuated Walls.

**NON-STRUCTURAL STEEL WALL FRAMING & CEILING SUSPENSION SYSTEMS****PART 3 - EXECUTION****3.1 EXISTING CONDITIONS**

- A. Verify that Structures and Surfaces to receive Work specified herein are straight, true, plumb, square, secure, rigid, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 GENERAL INSTALLATION REQUIREMENTS**

- A. Follow Referenced Specifications and Manufacturer's instructions, unless otherwise specified hereunder.

**3.4 ACOUSTIC SEALANT INSTALLATION**

- A. Prior to Stud and Runner installation, apply 2 beads of Sealant to back side of Studs and Runners which directly contact adjacent Solid Surface.
- B. Permit no Voids for Sound passage.

**3.5 WALL FRAMING INSTALLATION**

- A. Accurately locate and install plumb, true, and secure.
- B. Maximum Stud Spacing, unless otherwise shown on Drawings: 16 inches o.c.
- C. Isolate Stud Partitions from Structure to prevent transfer of loads or movement into Partitions.
- D. Where Stud Partitions stop at or slightly above Ceiling, brace Partition to Structure as required to stabilize Partitions.
- E. If, and where, Studs extend vertically past adjacent horizontal Structural Members, connect Stud to Structural Member with Side Clips.
- F. Do not splice Studs.
- G. Align Utility Openings in Stud Webs.
- H. Form Corners and Intersections with three Studs.
- I. Locate Studs within 2 inches of Internal Corners.
- J. Frame around Openings.

(Cont.)

**NON-STRUCTURAL STEEL WALL FRAMING & CEILING SUSPENSION SYSTEMS****PART 3 - EXECUTION****3.5 WALL FRAMING INSTALLATION (Cont.)**

- K. At any Studs not sheathed full-height on both faces, provide 1-1/2 inch wide by 16 ga. horizontal Steel Channel Bridging to prevent Stud rotation. Space Bridging 48 inches apart maximum, and secure to Stud Webs.
- L. Provide Partition-height Stud adjacent to Door Frame Jambs and secure to Jambs. Provide additional Partition-height Stud approximately 2 inches from each Jamb-stud and attach to Jamb-studs with Spacers 18 inches above Floor and at 12 and 27 inches below Door Frame top.
- M. Provide 18 ga. x 8 inch minimum width Galvanized Steel Backing Plate behind Wall-mounted Door Stops, and elsewhere to support Wall-hung loads such as Cupboards, Tackboards, Railings, Toilet Room Accessories, Building Equipment, etc. Verify exact locations.

**3.6 SUSPENDED CEILING FRAMING INSTALLATION**

- A. Follow Referenced Specifications, except as otherwise specified herein.
- B. Provide Runner Channels within 6 inches of Walls and other Ceiling interruptions.
- C. Where Mechanical and Electrical Equipment interfere with regular spacing of Hangers provide additional Hangers and Channels, and make necessary adjustments in Ceiling construction.
- D. Do not attach or pass Hangers through Ducts.
- E. Provide Framing around any recessed Light Fixtures, Expansion Joints, or other Ceiling Openings.
- F. At Exterior Soffits, provide Stiffeners as required to prevent Wind Uplift displacement.

**3.7 TYING FRAMING & FURRING MEMBERS**

- A. Material: Double-strand Tie Wire
- B. Splicing: Double-wrap tie
- C. Horizontal Stiffeners to Channel Brackets: Figure-eight tie
- D. Framing Members perpendicular to each other: Saddle tie

**3.8 ALLOWABLE INSTALLATION TOLERANCES**

- A. Maximum Deviation from:
  - 1. Specified Member Spacing: Plus or minus 1/8 inch
  - 2. True, Plumb, & Level where applicable: 1/8 inch per 10 ft.

**NON-STRUCTURAL STEEL WALL FRAMING & CEILING SUSPENSION SYSTEMS****PART 3 - EXECUTION****3.9 WASTE MANAGEMENT**

- A. Collect Metal Cut-offs and Scrap, and place where directed for recycling.

**3.10 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 EXTENT OF WORK**

- A. Where Spaces are scheduled to receive Gypsum Board, include any Closets or Alcoves opening off these Spaces and any Pilasters within Spaces, unless otherwise shown on Drawings.

**1.3 PRODUCTS INSTALLED, BUT FURNISHED UNDER OTHER SECTIONS**

- A. Access Hatches: Section 08-30-00

**1.4 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Exterior Gypsum Wall Sheathing: Section 06-10-00
- B. Steel Wall Framing & Ceiling Suspension Systems: Section 09-10-00
- C. Mineral Fiber Acoustic Insulation: Section 09-51-00
- D. Finish Painting: Section 09-90-00
- E. Wall Corner Guards: Section 10-26-00

**1.5 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.6 REFERENCED SPECIFICATIONS**

- A. General:
  - 1. Conform to Referenced Specifications hereinafter named, as Architect judges them applicable, and as modified and supplemented herein.
  - 2. Recommended materials and methods are mandatory; those proposed as equivalent by Contractor must be accepted by Architect.
- B. Metal Furring Installation:
  - 1. Comply with applicable requirements specified in ASTM C-754.
- C. Gypsum Board Application & Finishing:
  - 1. Standard Specifications for the Application and Finishing of Gypsum Board, ASTM Document C-840.

**PART 1 - GENERAL**

**1.7 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.8 REGULATORY AGENCY REQUIREMENTS**

- A. If and where Fire-rated Partitions or Ceilings are called for on Drawings, construct to obtain specified Rating.

**1.9 FIELD MOCK UP**

- A. Build Sample Panel at least 4x8 ft. size, where approved, and show typical Joint and Surface treatment, Corners, Control Joints, and Board termination against other Materials.
- B. Obtain Architect's review before proceeding.
- C. Accepted Sample, in like-new condition, may be used as part of Contract Work.

**1.10 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Deliver Products to Site with Manufacturer's original, legible Labels intact.
- B. Identify Fire-rated Materials with Testing Agency Label.
- C. Indicate Adhesive "open time" on Container Label.
- D. Protect Gypsum Material against moisture and Metal Materials against rust.
- E. Stack Gypsum Board on edge; do not stack flat or with longer lengths overhanging shorter lengths.

**1.11 ENVIRONMENTAL REQUIREMENTS**

- A. Perform Work only under the following conditions:
  - 1. Air Temperature for 24 hours before and during Work, and for 24 hours after Materials have dried: 55°F to 75°F
  - 2. Minimum Work Space Illumination measured 3 ft. above adjacent Floor: 30 ft. candles
  - 3. Ventilation: Maintain sufficient for proper Joint Treatment drying.

(Cont.)



**PART 2 - PRODUCTS**

**2.1 PRODUCTS - GENERAL**

- A. Manufacturers:
  - 1. Metal Products: Beadex, Scafco, Steeler, Steel Systems, US Gypsum, Western, or approved.
  - 2. Gypsum Products: Celotex, G.P., Gypsum, Gold Bond, James Hardie, Manville, National Gypsum, US Gypsum, or approved.
  - 3. Other Products: As specified hereunder.

**2.2 GYPSUM BOARD**

- A. Backer Board:
  - 1. Type: X
  - 2. Edges: Square or T&G
  - 3. Extent of Work: Use as base layer for double layer construction, except where Water-resistant Board is required.
- B. Water-resistant Board:
  - 1. Core: Asphalt-impregnated
  - 2. Type: X
  - 3. Extent of Work: Provide in Restroom Areas, and elsewhere within 6 ft. of Dishwashing Equipment, Sinks, and other Plumbing Fixtures.
- C. All Other Board:
  - 1. Type: X
  - 2. Edges: Tapered

**2.3 FASTENERS**

- A. Material: Steel
- B. Manufacturing Standard: ASTM C-1002
- C. Type & Length: Screws recommended by Board Manufacturer to satisfy conditions of use.

**2.4 ACCESSORIES & TRIM**

- A. At External Corners: Paper-faced similar to USG Beadex B1
- B. At Exposed Gypsum Board Edges & where Gypsum Board abuts other Materials: Paper-faced, J-shaped, similar to USG Beadex B9
- C. At Shrinkage Control Joints: Similar to USG 093

**PART 2 - PRODUCTS**

**2.5 JOINT TAPE & COMPOUND**

- A. Manufacturer & Brand: Contractor's choice
- B. Manufacturing Standard: ASTM C-475
- C. Type: Satisfy conditions of use.

**2.6 LAMINATING ADHESIVE**

- A. Made or recommended by Board Manufacturer.

**2.7 SURFACE SEALER**

- A. Manufacturer: Hamilton (714) 637-2770, or approved.
- B. Brand: Prep Coat Plus
- C. Extent of Work: Apply over Gypsum Board after taping and prior to applying Spray Texture.

**2.8 SPRAY-APPLIED TEXTURE COMPOUND**

- A. Manufacturer & Brand: U.S. Gypsum Spray Texture Finish, or approved.
- B. Extent of Work: Provide at Gypsum Board surfaces scheduled to receive Paint finish, except in the following locations:
  - 1. Entry Halls
  - 2. Multipurpose Rooms

**2.9 ACOUSTIC SEALANT**

- A. Manufacturer & Brand: Pecora BA-98 & AC-20, Tremco Acoustic Sealant, U.S. Gypsum Acoustic Sealant, or approved.
- B. Extent of Work: Provide at Sound-attenuating Walls.

**2.10 WATER RESISTANT SEALANT**

- A. Manufacturer: G.E., Dow, or approved.
- B. Material: Silicone with Mildew Inhibiter
- C. Manufacturing Standard: Fed. Spec. TT-S-001543
- D. Type: Satisfy conditions of use
- E. Color: Clear translucent

**PART 2 - PRODUCTS**

**2.11 OTHER MATERIALS**

- A. Made or recommended by Gypsum Board Manufacturer.
- B. Provide all indicated or required for complete installation.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces to receive Gypsum Board are accurately located, plumb, square, true, secure, dry, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.
- B. To prevent damage to Electrical Wiring, accurately cut openings in Board for Electrical Boxes prior to installing Board. Do not make Openings with Router after Board installation.

**3.3 GENERAL INSTALLATION REQUIREMENTS**

- A. Follow Referenced Specifications and Manufacturer's instructions, except as supplemented or modified herein.

**3.4 METAL ACCESS HATCH INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Accurately locate and securely anchor plumb, level, square, and true.

(Cont.)

**PART 3 - EXECUTION**

**3.5 ACOUSTIC SEALANT INSTALLATION**

- A. Apply Sealant around Electrical Boxes, Pipes, etc., located in or passing through Sound-attenuating Walls.
- B. Prior to installing Gypsum Board, provide Acoustic Sealant around Sound-attenuating Wall Perimeters in Angle between Walls, Floor, and Ceiling; press Board into Sealant forming bond between Framing Member face and backside of Board.
- C. Provide in Joints between Sound-attenuating Walls and other adjacent Materials.
- D. Permit no Voids for sound passage.

**3.6 GYPSUM BOARD INSTALLATION**

- A. Install Wallboard horizontally, and extend to within 1/4 inch of Floor.
- B. Loosely butt Joints.
- C. Except at Corners, place Tapered Edges together.
- D. Do not place Butt Edges against Tapered Edges.
- E. Offset Joints between successive layers, if any, and on opposite faces of walls.
- F. Where possible apply Boards without Butt Joints. Where Butt Joints are necessary, locate as far from Wall and Ceiling centers as possible and offset.
- G. Maintain 3/8 inch minimum distance between Fastener and Board Edge.
- H. Dimple Board Surface 1/32 inch with Fastener; do not fracture Face Paper.
- I. Secure Single-ply Boards and Base Layer of 2-ply Assemblies to Framing as follows:
  - 1. At Metal Wall Framing: Screw at 8 inches o.c. along Board perimeter and at 12 inches o.c. at Intermediate Supports.
  - 2. At Metal Ceiling Framing: Screw at 8 inches o.c. along each Support.
  - 3. At Metal Furring: Screw at 8 inches o.c. along each Furring Member.
  - 4. Board may, at Contractor's option, be secured to Wall and Ceiling Framing with Adhesive if also screwed to Wall Supports at 16 inches o.c. and to Ceiling Supports at 12 inches o.c.
- J. Secure Face Layer of 2-ply Assemblies to Base Layer as follows:
  - 1. Install Screws long enough to penetrate Metal Framing at least 1/4 inch and, space 12 inches o.c. along each Supporting Member, or
  - 2. Apply Full Adhesive covering between plies. Until Adhesive develops full bond, temporarily support Wall Face Layer in position with Fasteners or Shoring and permanently support Ceiling Face Layer with Fasteners.

(Cont.)

### **PART 3 - EXECUTION**

#### **3.7 SHRINKAGE CONTROL JOINTS**

- A. Provide Control Joints, unless otherwise shown on Drawings, as follows:
  - 1. If and where Framing changes direction
  - 2. Over Joints between dissimilar Substrates
  - 3. Where necessary to divide Gypsum Board into areas not exceeding:
    - a. 2-1/2 to 1 length to height Ratio
    - b. 30 ft. o.c.
  - 4. Elsewhere shown on Drawings
- B. Obtain Architect's Joint-location approval prior to starting Work.

#### **3.8 ALLOWABLE INSTALLATION TOLERANCES**

- A. Maximum Ceiling Deflection: 1/360 of span.
- B. Maximum Deviation from True Plane: 1/8 inch per 10 ft. and 1/16 inch in any running ft.

#### **3.9 JOINT, CORNER, & SURFACE TREATMENT**

- A. Protect External Corners and Exposed Edges with Metal Trim.
- B. Except at Backer Board, fill Board Joints, Internal Corners and Angles, Fastener Head Depressions, and Accessories as follows:
  - 1. At Gypsum Board: to receive Spray Texture:
    - a. Embed Tape in Joint Compound plus 3 additional coats of Compound.
    - b. Remove Tool Marks, Ridges, and excess Compound.
    - c. Cover Surface with Surface Sealer.
  - 2. At all other Gypsum Board:
    - a. Embed Tape in Joint Compound plus 3 additional coats of Compound.
    - b. Remove Tool Marks, Ridges, and excess Compound.
    - c. Cover Surface with Skim Coat of Compound.
    - d. Lightly sand or sponge to produce smooth surface.

#### **3.10 WATER RESISTANT SEALANT**

- A. Provide at Raw Edges and around Cutouts in Water-resistant Gypsum Board.

(Cont.)

**GYPSUM BOARD****PART 3 - EXECUTION****3.11 GROUTING HOLLOW STEEL DOOR FRAMES**

- A. Where Frames are installed in Gypsum Board Walls, hand-trowel Door Frame Heads and Jambs (not Mullions) full with the following:
  - 1. Material: Masonry Mortar made with Lime, Portland Cement, Sand, and Water.  
(*Do not use Plaster Mix or Taping Compound.*)
  - 2. Maximum Slump: 4 inches
- B. Allow Mortar to dry prior to installing Frames.

**3.12 SURFACE TEXTURE**

- A. At Surfaces to be Painted, except in Entry Halls & Multipurpose Rooms:
  - 1. Spray-apply Texture Compound to produce fine-spray Texture Finish in accordance with approved Mock Up.
  - 2. Follow Manufacturer's instructions.
- B. At all other Gypsum Board:
  - 1. Leave smooth without Texture.

**3.13 GYPSUM BOARD REPAIRING**

- A. General:
  - 1. After installation and before finishing, correct any Surface Damage or Defects.
  - 2. Leave Surfaces clean, uniform, and ready for Finishing specified in other Sections.
- B. Screw Pops:
  - 1. Repair by installing new Screw approximately 1-1/2 inch away from Projecting Screw and reset Projecting Screw.
  - 2. Where Face Paper is fractured install new Fastener approximately 1-1/2 inch away from Projecting Screw and remove Projecting Screw.
  - 3. Fill Damaged Surface with Joint Compound and finish flush and smooth.
- C. Ridging:
  - 1. Sand Ridges smooth without cutting Joint Tape.
  - 2. Fill Concave Areas on both sides of Ridge with Compound and finish flush and smooth.
- D. Cracks:
  - 1. Fill with Joint Compound and finish flush and smooth.

**3.14 WASTE MANAGEMENT**

- A. Collect Gypsum and Metal Scrap, and place where directed for recycling.
- B. Do not include Asphalt-impregnated Gypsum Board, or Gypsum Board coated with Paint or other Finish.
- C. Protect Gypsum Waste against Moisture and Contamination.

**PART 3 - EXECUTION**

**3.15 PRODUCT CLEANING & OTHER REPAIRING**

- 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. Remove excess Joint Compound and any other Finishing Compounds from Floors and other Surfaces.
- C. Broom-clean Work areas.
- D. Leave Surface ready for Finishing specified in other Sections.
- E. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Acoustic Caulking: Section 09-25-00
- B. Mineral Fiber Acoustic Insulation: Section 09-51-00

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 REFERENCED SPECIFICATIONS**

- A. For Suspension Systems, hereinafter specified, comply with:
  - 1. "Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings": ASTM C-635
  - 2. "Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustic Tile and Lay-in Panels": ASTM C-636

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.6 CERTIFICATION OF CODE COMPLIANCE**

- A. Prior to starting Work, submit to Architect written certification that Ceiling System complies with Seismic Loading requirements of Building Code and that System is acceptable to Building Official.

**1.7 PRODUCT DELIVERY**

- A. Deliver Tile in original, unopened, protective packages with Manufacturer's legible Labels indicating brand name, pattern, size, thickness, and fire rating, if any.



**PART 1 - GENERAL**

**1.8 PRODUCT STORAGE & HANDLING**

- A. Protect against moisture, damage, and discoloration.
- B. Store Tile Cartons open at each end to stabilize moisture content and temperature.
- C. Do not store Tile near Materials that could off-gas or emit Harmful Fumes, such as Gas Heaters, fresh Paint, Adhesives, etc.

**1.9 ENVIRONMENTAL REQUIREMENTS**

- A. Delay installation of Acoustic Units until Work Spaces are dry.
- B. Perform Work only under the following conditions for 24 hours before, and during and after installation:
  - 1. Humidity: Approximately match final-use Humidity
  - 2. Ambient Air Temperature: 55°F to 80°F

**1.10 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**1.11 EXTRA STOCK**

- A. Submit 1 extra unopened-case of Acoustic Tile in unopened protective package.
- B. Store on Project Premises where directed by Owner.

**PART 2 - PRODUCTS**

**2.1 ACOUSTIC TILE**

- A. Manufacturer:
  - 1. Armstrong, Celotex, USG Interiors, or approved.
  - 2. Manufacturers listed above are approved provided they can supply Units that match specified pattern to Architect's satisfaction.

(Cont.)

**PART 2 - PRODUCTS**

**2.1 ACOUSTIC TILE (Cont.)**

- B. Facing:
  - 1. Material: Manufacturer's standard factory-applied Paint finish
  - 2. Color: White
- C. Minimum U.L. Fire Resistance Rating: None required
- D. ASTM E-84 Flame Spread Class: A
- E. Maximum ASTM E-84 Smoke Development Rating: 450
- F. Pattern: Match Armstrong \_\_\_\_\_
- G. Face Size: 24x48 inches
- H. Edge Shape: Square

**2.2 TILE SUSPENSION SYSTEM**

- A. Manufacturer: Armstrong, Chicago Metallic, Donn, or approved.
- B. Material: Steel
- C. Type: Heavy-duty, exposed Tee in 2 directions, all Tile removable for access to Space above.
- D. Face Width: 15/16 inch
- E. Minimum U.L. Fire Resistance Rating: None required
- F. Edge Trim: Match Suspension System
- G. Finish: Manufacturer's standard Enamel
- H. Color: Match adjacent Acoustic Tile.
- I. Layout: See Drawings

**2.3 FASTENERS & ACCESSORIES**

- A. Type & Sizes: Recommended by Suspension System Manufacturer

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that structure and surfaces to receive System Components are properly prepared to receive Components.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**PART 3 - EXECUTION**

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. General:
1. Follow Referenced Specifications, Manufacturer's instructions, and Layout Drawings, except as modified hereunder.
  2. Delay start of Work until above-ceiling Work by other Trades has been completed.
- B. Tile Suspension System:
1. Where Mechanical and Electrical Work interferes with regular spacing of Hangers, provide additional Hangers and Channels and make necessary adjustments in Ceiling construction.
  2. Do not attach to or pass Hangers through Mechanical or Electrical Ductwork.
  3. Provide Framing around any recessed Lighting Fixtures and other Openings.
  4. Maximum Vertical Hanger Splay: 6 inches per 4 ft.
- C. Acoustic Tile:
1. Install in level plane, in straight line courses, and with solid bearing on Support Members.
  2. Minimum Border Tile Width: 1/2 Unit dimension, unless otherwise shown on Drawings.
  3. Install any Pattern grain in one direction.
  4. Seal Openings around any Pipe, Duct, or other penetrations through Tile with Foam Penetration Sealant specified in Section 07-92-00.
  5. Where Acoustic Tiles abut Vertical Surfaces, trim Joints with Suspension System Metal Edge Trim.
- D. Hold Down Clips:
1. Provide at any time during Warranty Period where Ceiling Units are dislodged by Air Pressure.
  2. Provide at any Fire-rated Ceiling Units weighing less than 1 psf.

**3.4 ALLOWABLE INSTALLATION TOLERANCES**

- A. Maximum fully loaded Ceiling Deflection in accordance with ASTM C-635: 1/360 of Span
- B. Install Finish Surfaces level and true within 1/8 inch per 12 ft.
- C. Maximum Ceiling Suspension System Runner rotation from plumb: 2°

**PART 3 - EXECUTION**

**3.5 WASTE MANAGEMENT**

- A. Collect Metal Cut-offs, Scrap and Packaging, and place where directed for recycling.
- B. Store where directed 2 sq. ft. & larger Tile pieces for Patching and Infill Work.
- C. Determine and take advantage of Manufacturer's recycling options.

**3.6 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Gypsum Board to receive Wall Tiles: Section 09-25-00

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show dimensions, attachment methods, and other pertinent information.

**1.6 SAMPLES**

- A. Submit in accordance with Section 01-33-00.
- B. Include 2 full-size Tiles showing size, shape, surface texture, and color.

**1.7 INSTALLER'S QUALIFICATIONS**

- A. Employed by or acceptable to Tile Manufacturer.

**1.8 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.

**PART 2 - PRODUCTS**

**2.1 TILES**

- A. Manufacturer: Kirei USA, or approved.
- B. Brand: \_\_\_\_\_
- C. Model: \_\_\_\_\_
- D. Color: \_\_\_\_\_
- E. ASTM C423 Noise Absorption Rating (NRC): 0.60
- F. ASTM E84 Fire Rating Class: A
- G. Attachment Method: \_\_\_\_\_

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces to receive Tiles are properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Position plumb, level, square, straight, and true as applicable.
- C. Securely anchor to adjacent Construction.

**3.4 WASTE MANAGEMENT**

- A. Collect Metal Strapping & Packaging Waste, and place where directed for recycling.

**3.5 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon work completion or sooner, if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Thermal Insulation: Section 07-20-00
- B. Steel Framing to receive Acoustic Insulation: Section 09-10-00
- C. Acoustic Caulking: Section 09-25-00

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against moisture, damage, and discoloration.
- B. Do not store Insulation near Materials that could off-gas or emit Harmful Fumes, such as Gas Heaters, fresh Paint, Adhesives, etc.

**1.6 ENVIRONMENTAL REQUIREMENTS**

- A. Delay Insulation installation until Work Spaces are dry.

**1.7 ADVANCE NOTICES**

- A. Notify Architect at least 24 hours prior to covering-over Work of this Section so inspection can be made.

**PART 2 - PRODUCTS**

**2.1 ACOUSTIC INSULATION**

- A. Manufacturer: Contractor's choice
- B. Material: Formaldehyde-free Mineral Wool Insulation
- C. Manufacturing Standard: ASTM C-665
- D. Type: Friction-fit Batt
- E. Length: Full-length, single-piece where practicable
- F. Special Requirement: UL Rated for Plenum-use if and where located above Ceiling.
- G. Thickness: Fill Wall-framing and Ceiling-framing Cavity
- H. Extent of Work: Provide in Sound-attenuating Walls, including where Walls extend above Ceiling.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces provided by other Trades are clean, dry, and otherwise properly prepared to receive Acoustic Insulation.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. Install Insulation between Framing Members butting joints tight with no voids.
- B. Extend Insulation behind Electrical Boxes located in Sound-attenuating Walls.

**3.4 WASTE MANAGEMENT**

- A. Collect Scrap and Packaging, and place where directed for recycling.

(Cont.)



**PART 3 - EXECUTION**

**3.5 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 AREAS TO BE COVERED**

- A. Where Floor Covering is scheduled:
1. Cover any Closet or Alcove Floors opening off these Spaces with same Material.
  2. Provide Floor Covering under Operable Partitions.
  3. Covering not permitted under permanently built-in Casework and Equipment, unless otherwise indicated elsewhere.
- B. Where Base is scheduled:
1. Provide around perimeter of Room or Space, unless otherwise indicated elsewhere.
  2. Include Casework, Free-standing Columns, Pilasters, and other Projections, if any.

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Leveling uneven Concrete Floor Slabs: Section 03-30-00  
B. Carpet: Section 09-68-00  
C. Epoxy Aggregate Covering: Section 09-72-00

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 REFERENCED SPECIFICATIONS**

- A. Comply with applicable requirements of Standard Specifications and Recommended Work Procedures for Resilient Floor Coverings published by the Resilient Floor Covering Institute.
- B. Copies can be obtained from Institute at 966 Hungerford Dr.; Suite 12-B; Rockville, MD 20850; (301) 340-8580.

**1.6 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**PART 1 - GENERAL**

**1.7 SAMPLES**

- A. In accordance with Section 01-33-00, submit the following:
  - 1. Two full size samples of each specified Floor Tile.
  - 2. Two 12x12 inch wide samples of each specified Sheet Covering.

**1.8 MAINTENANCE INSTRUCTIONS**

- A. In accordance with Section 01-83-00, submit Manufacturer's recommended Maintenance Products and Methods to General Contractor, for inclusion in Owner's Maintenance Manual.

**1.9 INSTALLER'S QUALIFICATIONS**

- A. Acceptable to Covering Manufacturer.

**1.10 REGULATORY AGENCY REQUIREMENTS**

- A. Install Conductive Floor Tile in compliance with Building Code and NFPA Bulletin 56 requirements, if more restrictive than those specified herein.
- B. Notify Architect about any of differences prior to starting work.

**1.11 PRODUCT DELIVERY**

- A. Deliver in unopened Packages with Manufacturer's original, legible Labels thereon.
- B. Matching Coverings shall bear Manufacturer's Run Number.
- C. Do not remove Labels or open Packages until Architect inspects.

**1.12 PRODUCT STORAGE & HANDLING**

- A. Protect against damage and discoloration.
- B. Store in dry place.
- C. Maintain Storage Place Temperature above 70°F for immediate 48 hours prior to and during storage.

(Cont.)

**PART 1 - GENERAL**

**1.13 ENVIRONMENTAL REQUIREMENTS**

- A. Perform Work only under the following Minimum Conditions:
  - 1. Ambient Air Temperature during application and thereafter: 70°F
  - 2. Substrate Surface Temperature: 70°F
  - 3. Work Area Illumination measured 3 ft. above Floor: 30 foot candles
  - 4. Ventilation: If and when using offensive smelling Adhesive, provide sufficient Ventilation to maintain healthy and pleasant environment for Building Occupants.

**1.14 EXTRA STOCK**

- A. Leave with Owner 1 extra unopened case of each Floor Tile.
- B. Leave with Owner 3 ft. minimum length of full-width Sheet Covering remnants.
- C. Store on Project Premises where directed by Owner.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Covering Materials shall have uniform size and thickness, straight edges, square corners, uniform pattern, and uniform color extending through entire thickness of Material.

**2.2 COLORS & PATTERNS**

- A. Selected by Architect after Contract award from Manufacturer's standard choices.
- B. Manufacturers listed herein are approved, provided their Material matches selected color and pattern to Architect's satisfaction.

**2.3 LUXURY VINYL TILE**

- A. Manufacturer: Armstrong, or approved.
- B. Brand: \_\_\_\_\_
- C. Face Size: \_\_\_\_\_

(Cont.)

**PART 2 - PRODUCTS**

**2.4 STATIC DISSIPATIVE VINYL COMPOSITION TILE**

- A. Manufacturer & Brand: Armstrong SDT, or approved.
- B. Manufacturing Standard: Fed. Spec. SS-T-312B(1) type IV Composition 1, except for para. 3.9.2 Deflection
- C. Thickness: 1/8 inch
- D. Face Size: 12x12 inches
- E. Required Accessories:
  - 1. 2x24 inch Copper Grounding Strips
  - 2. Static Dissipative Adhesive
  - 3. Static Dissipative Polish

**2.5 SHEET VINYL**

- A. Manufacturer: Armstrong, or approved.
- B. Brand: Abode
- C. Manufacturing Standard: ASTM F1303 Type 1, Grade 1
- D. Minimum Wear Level Thickness: 0.080 inches
- E. Factory Finish: UV-cured Polyurethane

**2.6 RUBBER BASE**

- A. Manufacturer: Armstrong, Burke, Flexco, Goodrich, Johnsonite, Mercer, Noramet, Roppe, Textile, VPI, or approved.
- B. Manufacturing Standard: ASTM F-1861
- C. Type: Top-set with Coved Toe
- D. Height:
  - 1. At Restroom Areas: 6 inches
  - 2. Elsewhere: 4 inches
- E. Length: Continuous Rolls
- F. Required Accessories:
  - 1. Mitered Internal Corners
  - 2. Factory-formed External Corners equipped with Tab Extensions for installation behind adjacent Wall Base
  - 3. Factory-formed End Stops

(Cont.)

**PART 2 - PRODUCTS**

**2.7 REDUCING EDGE STRIPS**

- A. Manufacturer: Contractor's choice
- B. Material: Rubber
- C. Shape: Beveled
- D. Maximum Thickness: Match adjacent Flooring.
- E. Width: 1 inch
- F. Extent of Work: Provide at any exposed Resilient Flooring edges.

**2.8 PRIMER, SEALER, CRACK FILLER, & ADHESIVE**

- A. Water-resistant type made or recommended by Covering Manufacturer for conditions of use, including Moisture-content and Substrate-porosity. Both Tests are specified in Section 01-45-30

**2.9 SEALANT**

- A. Material: Silicone
- B. Manufacturer & Brand: Contractor's choice
- C. Color: Clear Translucent
- D. Manufacturing Standard: ASTM C-920, Type S, Class 25, Grade NS.
- E. Required Ingredient: Mildew Inhibitor
- F. Extent of Work: Provide in Restrooms at Joint between Rubber Base and Floor.

**2.10 CLEANER**

- A. Low-VOC and neutral type made or recommended by Covering Manufacturer for conditions of use.

**2.11 POLISH**

- A. Low-VOC, non-slip, non-yellowing type made or recommended by Flooring Manufacturer for conditions of use, and compatible with Owner's normal polishing materials and methods.
- B. Extent of Work: Provide if and where recommended by Flooring Manufacturer.

(Cont.)

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces to receive Work specified herein are solid, clean, level, and otherwise properly prepared.
- B. Verify that Concrete Slabs to receive Covering do not exceed Moisture and Vapor limits specified by Covering Manufacturer, as determined by Tests specified in Section 01-45-30.
- C. Verify that any Walls to receive Wall Base extend to within 1/4 inch of Floor.
- D. Prior to starting Work, notify General Contractor of defects requiring correction.
- E. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 SURFACE PREPARATION**

- A. Fill Concrete Slab Cracks less than 1/16 inch wide and Depressions less than 1/8 inch deep with Crack Filler. Notify General Contractor to correct wider Cracks and deeper Depressions.

**3.4 LAYOUT**

- A. Tile Patterns:
  - 1. Unless otherwise shown on Drawings, layout Tile Field so that no Perimeter Tile is narrower than 1/2 of a full-size Tile.
  - 2. Layout Tile as shown on Drawings.
  - 3. Install Tile in 'quarter-turn' checkerboard pattern.

**3.5 INSTALLATION**

- A. General:
  - 1. Follow Manufacturer's Instructions and applicable sections of Referenced Specifications.
- B. Tile:
  - 1. At least 24 hours before installing, remove Tile from Shipping Cartons and back-stack.
- C. Sheet Flooring:
  - 1. Install with minimum practicable Seams in accordance with Manufacturer's recommended method.

(Cont.)

**PART 3 - EXECUTION**

**3.5 INSTALLATION (Cont.)**

- D. Static Dissipative Tile:
  - 1. Locate Grounding Strips approximately 25 ft. apart around installation perimeter. Extend Strips 18 inches into Adhesive and 6 inches up Wall face for connection to Grounding System by Electrician.
- E. Rubber Base:
  - 1. General: Install Factory-formed External Corners with Contact Cement.
  - 2. At Restrooms:
    - a. Set Base in Sealant Bead previously applied to Floor.
    - b. Strike-off any surplus Sealant flush with Base.
    - c. Remove any surplus Sealant from Base and Floor.
- F. Reducing Edge Strips:
  - 1. Provide wherever Flooring edges are exposed.
  - 2. If Flooring terminates at Door opening, center Strip under Door.

**3.6 STATIC DISSIPATIVE TILE TESTING**

- A. Approximately 1 month after installation, make tests prescribed by Federal Test Method 4060 (101C).
- B. Remove, re-lay, and re-test Floors which fail to meet Tests.

**3.7 WASTE MANAGEMENT**

- A. Half-size & Larger Surplus Tile: Set aside for Owner's reuse or donate to Organizations such as Habitat for Humanity.
- B. Partly-used Adhesive Containers: Tightly-seal and store in protected, well-ventilated, and fire-safe area maintained at moderate temperature.
- C. Cardboard & Metal Waste: Collect and place where directed for recycling.

**3.8 CLEANING, REPAIRING, & POLISHING**

- A. Do not let Dirt or Soil accumulate on installed Surfaces; if necessary sweep or vacuum daily.
- B. After Covering and Adhesive have set sufficiently, wash with Cleaner.
- C. After rinsing and drying, apply one coat of Polish to Covering. Machine-buff to smooth and dull-gloss. Hand-buff inaccessible areas.
- D. Leave Surfaces smooth and defect-free.
- E. 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.
- F. Remove Debris from Project Site upon Work completion, or sooner if directed.



**PART 3 - EXECUTION**

**3.9 PROTECTING COMPLETED WORK**

- A. Rope-off Work areas and/or provide necessary Coverings to protect Work of this Section.

**END OF SECTION**

**CARPET****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 AREAS TO BE COVERED**

- A. Where Carpet is scheduled:
  - 1. Cover any Closet or Alcove Floors opening off these Spaces with same Material.
  - 2. Provide Carpet under Operable Partitions.
  - 3. Do not provide Carpet under permanently built-in Casework or Equipment, unless otherwise shown on Drawings.

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Leveling of uneven Concrete Slabs: Section 03-30-00
- B. Rubber Base at Carpet Perimeters: Section 09-65-00

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.6 SAMPLES**

- A. Prior to ordering and in accordance with Section 01-33-00, submit the following:
  - 1. Two full-size Carpet Tile samples of each Carpet type and color.
  - 2. Two 12 inch long samples of each type of Edge Strip.

**1.7 MAINTENANCE INSTRUCTIONS**

- A. In accordance with Section 01-83-00, submit Instructions to General Contractor for inclusion in Owner's Maintenance Manual.

**CARPET****PART 1 - GENERAL****1.8 REGULATORY AGENCY REQUIREMENTS**

- A. Maximum Carpet System Flame Spread & Smoke Development: Comply with applicable Building Code requirements.

**1.9 CERTIFICATION OF COMPLIANCE**

- A. Submit Carpet Manufacturer's affidavit which certifies that:
  - 1. Installer is authorized to perform Work.
  - 2. Installed Carpet was manufactured in accordance with Specification requirements.
- B. Replace non-complying Products at no cost to Owner.

**1.10 PRODUCT DELIVERY**

- A. Do not deliver Carpet until installation is ready to start.

**1.11 PRODUCT STORAGE & HANDLING**

- A. Protect against damage and discoloration.
- B. Do not store Rolled Goods on end.

**1.12 ENVIRONMENTAL REQUIREMENTS**

- A. Perform Work only under the following Minimum Conditions:
  - 1. Ambient Air Temperature:
    - a. During installation & for 72 hours thereafter: 65°F - 95°F
    - b. Beyond 72 hours after installation: 55°F minimum
  - 2. Substrate Surface Temperature: 65°F
  - 3. Work Area Illumination measured 3 ft. above Floor: 30 ft. candles
  - 4. Ventilation: If and when using offensive smelling Adhesive, provide sufficient Ventilation to maintain healthy and pleasant environment for Building Occupants.

**1.13 SPECIAL WARRANTY**

- A. Warrant for 5 years that Carpet will maintain specified limits of Static Electricity generation.
- B. Warrant for 10 years that Carpet will lose no more than 10% Face Fiber by weight.
- C. At no additional cost to Owner, correct defects in materials and workmanship which appear during Warranty Period by repairing, or when directed by replacing.

**CARPET****PART 1 - GENERAL****1.14 MAINTENANCE MATERIALS**

- A. For each type, pattern, and color of Carpet leave 1 extra unopened case of each type and color of Carpet Tile.
- B. Store on Project Premises where directed by Owner.

**PART 2 - PRODUCTS****2.1 CARPET TILE**

- A. Manufacturer: \_\_\_\_\_, or approved.
- B. Pattern: \_\_\_\_\_
- C. Color: Selected by Architect after Contract award from Manufacturer's standard choices.
- D. Tile Size: \_\_\_\_\_ inches
  - 1. Gauge: \_\_\_\_\_ inch
  - 2. Stitches per inch: \_\_\_\_\_
  - 3. Pile Height: \_\_\_\_\_ inch
  - 4. Face Fiber: \_\_\_\_\_
  - 5. Ply: \_\_\_\_\_
  - 6. Dying Method: \_\_\_\_\_
  - 7. Minimum Face Weight: \_\_\_\_\_ oz. per sq. yd.
  - 8. Primary Backing Material: \_\_\_\_\_
  - 9. Secondary Backing Material: \_\_\_\_\_
  - 10. Minimum Total Weight: \_\_\_\_\_ oz. per sq. yd.
  - 11. Static Electricity Control Fiber: Manufacturer's standard type blended with Carpet Fiber. Maximum Electrostatic Charge: 3.0 KV at 20% relative humidity at 70°F.

**2.2 CUSHION**

- A. None required.

**2.3 CONCRETE SEALER**

- A. Manufacturer & Brand: Contractor's choice
- B. Type: Satisfy conditions of use.
- C. Maximum VOC Emission Level: 250 g/l
- D. Extent of Work: Provide if and where recommended by Carpet Manufacturer.

**CARPET****PART 2 - PRODUCTS****2.4 EDGE STRIP**

- A. Manufacturer & Brand: Mercer Snap Down, Roberts Universal Moulding System, or approved.
- B. Insert Material: Vinyl
- C. Insert Color: Match adjacent Rubber Base specified in Section 09-65-00.

**2.5 ADHESIVE & FLOOR FILLER**

- A. Manufacturer: Contractor's choice
- B. Material: Non-flammable type recommended by Carpet Manufacturer

**2.6 PROTECTIVE COVERING**

- A. Manufacturer & Brand: Velcro Carpet Protection (800) 225-0180, or approved.
- B. Material: Non-woven, water-resistant, breathable, without pressure-sensitive adhesives.

**PART 3 - EXECUTION****3.1 EXISTING CONDITIONS**

- A. Verify that Subfloor is clean, dry, level, and solid; with no projections or holes that will damage Carpet System; that Work Spaces have specified illumination, humidity, and temperature; and that Surfaces are otherwise properly prepared.
- B. Prior to starting Work notify General Contractor about defects requiring correction.
- C. Verify that Concrete to receive Covering does not exceed Moisture and Vapor limits specified by Covering Manufacturer, as determined by Tests specified in Section 01-45-30.
- D. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

(Cont.)

**CARPET****PART 3 - EXECUTION****3.3 PREPARATION WORK**

- A. Fill Concrete Slab Cracks less than 1/16 inch wide and Depressions less than 1/8 inch deep with Floor Filler. Notify General Contractor to correct wider Cracks and deeper Depressions.
- B. Remove any Dust, Foreign Matter, or Moisture from Substrate.
- C. Air-out Carpet in well-ventilated and uninhabited space for 24 hours minimum.
- D. Acclimate Carpet to Work Space Environment for at least 48 hours before starting Work.

**3.4 EDGE STRIP INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Provide Edge Stripping at exposed Carpet edges.
- C. Where Carpet terminates at Door opening, center Edge Strip under Door.

**3.5 CARPET TILE LAYOUT**

- A. Minimum Perimeter Tile Width: 1/2 of full Tile size, unless otherwise shown on Drawings or otherwise approved by Architect.
- B. Install Tile in Stack Bond with continuous straight line joints in both directions.
- C. Install any Tile "grain" in quarter-turn checkerboard-pattern.

**3.6 ADHESIVE APPLICATION**

- A. Follow Manufacturer's instructions.
- B. Apply uniformly over full area to receive Carpet Tile.
- C. Application Method: Thin-coat
- D. Apply only to area that can be covered by Carpet within Adhesive working-time.
- E. Promptly remove any Adhesive spillages.

**3.7 CARPET TILE INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Installation Method: Direct Glue-down
- C. Match any Layout Pattern shown on Drawings.
- D. Fit neatly into Breaks and Recesses; against Bases; around Pipes and Penetrations; under Saddles, Ventilator Grilles, and Thresholds; and around Cabinet and Equipment perimeters.
- E. Where Tile terminates at Door openings center exposed Tile edge directly under Door.

**CARPET****PART 3 - EXECUTION****3.8 WASTE MANAGEMENT**

- A. Where possible, take advantage of Manufacturer's Recycling Program.
- B. Remnants, other than those set aside for Owner's future use: Donate to Organizations such as Habitat for Humanity.
- C. Partly-used Adhesive Containers: Tightly-seal and store in protected, well-ventilated, and fire-safe area maintained at moderate temperature.
- D. Packaging & Metal Waste: Collect and place where directed for recycling.

**3.9 CLEANING & REPAIRING**

- A. Do not let Dirt or Soil accumulate on installed Carpet; vacuum daily if necessary.
- B. After completing Work, vacuum-clean Carpet.
- C. Remove Debris from Project Site upon Work completion, or sooner if directed.
- D. 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.

**3.10 DEMONSTRATIONS**

- A. After installation, instruct Owner on proper care, cleaning, and maintenance of Carpet and proper Tile relocation procedures.

**3.11 PROTECTING COMPLETED WORK**

- A. Provide Coverings and Barricades necessary to protect completed Work.

**END OF SECTION**

**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 EXTENT OF WORK**

- A. In Spaces scheduled to receive Covering:
1. Include any Closet and Alcove surfaces opening off Spaces.
  2. Covering not required under permanently built-in Case Work and Equipment unless otherwise noted on Drawings.

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Concrete Substrate: Section 03-30-00

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.6 SAMPLES**

- A. Prior to ordering Materials, submit Manufacturer's standard Color Samples to Architect for selection.

**1.7 APPLICATOR'S QUALIFICATIONS**

- A. To be eligible to perform Work specified herein Applicator must have successfully completed 2 similar projects, and be employed by or acceptable to Covering Manufacturer.



**PART 1 - GENERAL**

**1.8 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Deliver in unopened Containers with Manufacturer's original, legible Labels thereon.
- B. Do not remove Labels or open Packages until Architect inspects.
- C. Protect against damage.
- D. Maintain Storage Space dry and between 60° F to 70° F.

**1.9 ENVIRONMENTAL REQUIREMENTS**

- A. Perform Work only under the following Minimum Conditions:
  - 1. Ambient Air Temperature during application and thereafter: 70°F
  - 2. Substrate Surface Temperature: 60°F
  - 3. Work Area Illumination measured 3 ft. above Floor: 30 foot candles
  - 4. Ventilation:
    - a. Air Changes per hour: 3
    - b. Exhaust Contaminated Air directly to Building outside, unless otherwise approved.

**1.10 PRE-INSTALLATION MEETING**

- A. Prior to starting work, and in accordance with Section 01-31-50, Covering Subcontractor shall arrange meeting to clarify any questions about Specifications, details, and other application requirements.
- B. Representatives of the following shall attend:
  - 1. General Contractor
  - 2. Covering Subcontractor
  - 3. Covering Manufacturer
  - 4. Covering-mounted Equipment Subcontractors, if any
  - 5. Covering-penetrating Equipment Subcontractors, if any.

(Cont.)

**PART 1 - GENERAL**

**1.11 MAINTENANCE WARRANTY**

- A. Prior to Final Project Acceptance and in accordance with Section 01-83-00, submit the following Maintenance Warranty for inclusion in Owner's Maintenance Manual:
1. We, the Undersigned, do hereby warrant Covering for 2 years following Project Substantial Completion date, against failure due to defective materials and/or workmanship, for System to remain watertight, and to repair or replace without additional cost to Owner any water leaks and resulting damage to Building Materials and/or Building Contents as may occur under normal usage within Warranty Period.

FLOORING SUBCONTRACTOR: \_\_\_\_\_  
By: \_\_\_\_\_

GENERAL CONTRACTOR: \_\_\_\_\_  
By: \_\_\_\_\_

**PART 2 - PRODUCTS**

**2.1 EPOXY AGGREGATE SYSTEM**

- A. Manufacturer & Brand: Crossfield Dex-O-Tex Decor-Flor, or approved.  
B. Color: Selected by Architect after Contract award from Manufacturer's standard choices.

**2.2 EDGE STRIPS**

- A. Manufacturer: American Terrazzo Strip Co., or approved.  
B. Material: 1-piece Stainless Steel  
C. Depth: Match adjacent Flooring System  
D. Extent of Work: Provide at any exposed Flooring Edges.

(Cont.)

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Substrate to receive Covering is clean, solid, smooth, and true within 1/8 inch plus or minus per 10 ft. in any direction.
- B. Verify that Concrete Slabs to receive Covering do not exceed Moisture and Vapor limits specified by Covering Manufacturer, as determined by Tests specified in Section 01-45-30.
- C. Prior to starting Work, notify General Contractor about defects requiring correction.
- D. Do not start Work until conditions are satisfactory.

**3.2 PROTECTION**

- A. Take necessary precautions to avoid Fire and Explosion.
- B. Protect Work of other Sections against damage and discoloration caused by Work of this Section.

**3.3 COVERING INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Minimum Thickness: 1/8 inch
- C. Texture: Smooth

**3.4 EDGE STRIPS**

- A. Follow Manufacturer's instructions.
- B. Anchor at ends and at 12 inch maximum centers between.
- C. Where Flooring terminate at Door opening, center Strip under Door.

**3.5 WASTE MANAGEMENT**

- A. Surplus Covering: Set aside for Owner's reuse or donate to Organization such as Habitat for Humanity.
- B. Partly-used Covering Containers: Tightly-seal and store in protected, well-ventilated, fire-safe area maintained at moderate temperature, and designated for hazardous materials
- C. Metal Waste: Collect and place where directed for recycling.

(Cont.)

**PART 3 - EXECUTION**

**3.6 PRODUCT CLEANING & REPAIRING**

- A. Remove Protective Covering from other finish surfaces.
- B. 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.
- C. Remove Debris from Project Site upon Work completion, or sooner if directed.

**3.7 PROTECTING COMPLETED WORK**

- A. Provide necessary Barricades and Coverings to protect Work of this Section against damage and discoloration until Work is sufficiently cured to protect itself.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Temporary Sign Painting, Temporary Heat, & Temporary Light: Section 01-50-00
- B. Fabricated Steel Shop Painting: Sections 05-10-00 & 05-50-00
- C. Sheetmetal Shop Painting: Sections 07-61-00 & 07-62-00
- D. Roof Accessories Shop Painting: Section 07-72-00
- E. Joint Sealants: Section 07-92-00
- F. Hollow Steelwork Shop Painting: Section 08-11-00
- G. Wood Door Factory-finishing: Section 08-21-00
- H. Access Hatches Shop Painting: Section 08-30-00
- I. Sectional Overhead Door Shop Painting: Sections 08-36-00 & 08-36-50
- J. Acoustic System Suspension Tee Shop Painting: Section 09-50-00
- K. Seamless Floor Covering: Section 09-72-00
- L. Mechanical Equipment Screens Shop Painting: Section 10-20-00
- M. Metal Locker & Locker Room Equipment Shop Painting: Section 10-50-00
- N. Miscellaneous Specialties Shop Painting: Section 10-99-00
- O. Equipment Shop Painting: Division 11
- P. Window Blind Shop Painting: Section 12-51-00
- Q. Crane Shop Painting: Section 14-60-00
- R. Mechanical Equipment Shop Painting: See HVAC & Plumbing Specifications
- S. Electrical Equipment Shop Painting: See Electrical Specifications

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 PRODUCTS LIST**

- A. Before ordering, submit complete List of Materials proposed for use.
- B. Obtain Architect's acceptance before ordering.

**PART 1 - GENERAL**

**1.6 COLOR SAMPLES**

- A. In accordance with Section 01-33-00, submit 2 Samples of each specified Finish, Color, and Sheen.
- B. Minimum Sample Size: 8-1/2 x 11 inches
- C. Sample Substrates:
  - 1. For Paint: Stiff Paper, or approved.
  - 2. For Stains & Varnishes: Specified Wood
- D. Obtain Architect's acceptance before proceeding with Contract Work.

**1.7 FIELD MOCK UP**

- A. Before proceeding with Contract Work, apply where directed each specified Coating on actual Work Surfaces.
- B. Include at least the following:
  - 1. Walls: 100 sq. ft.
  - 2. Ceilings: 100 sq. ft.
  - 3. Doors & Door Frames: 1
  - 4. Wood-faced Cabinets: 1
- C. Simulate Contract Lighting during Architect's review.
- D. Prior to starting Project Work, adjust Mock-up Colors as directed by Architect at no additional cost to Owner.
- E. Accepted Mock Up represents Minimum Acceptance Standard for Subsequent Work.
- F. Accepted Mock Up, in like-new condition, may be used in Contract Work.

**1.8 CERTIFICATE OF COMPLIANCE**

- A. Submit Affidavit from Paint Manufacturer's Architectural Service Representative that Products and Work of this Section comply with these Specifications.

**1.9 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Deliver in Manufacturer's original, unopened Containers with legible Labels intact.
- B. Do not open Containers or remove Labels until Architect inspects.
- C. Store in suitable location where directed by General Contractor.
- D. Protect against damage and contamination.
- E. Remove unacceptable Materials from Project Site.

**PART 1 - GENERAL**

**1.10 PRODUCT LABELS**

- A. Each Product Container Label shall include:
  - 1. Manufacturer's Name
  - 2. Type of Material
  - 3. Manufacturer's Product Number
  - 4. Manufacturer's Batch Number
  - 5. Color
  - 6. Instructions for reducing when applicable

**1.11 WORK SPACE ENVIRONMENTAL REQUIREMENTS**

- A. Comply with Manufacturer's recommendations.
- B. Perform Work only under the following conditions, unless otherwise instructed by Manufacturer:
  - 1. Maximum Relative Humidity: 85%
  - 2. Minimum Dew Point Variance between Air & Surface Temperature: 5°F.
  - 3. Minimum Ambient Air & Surface Temperature during application and until Film is dry-hard thereafter: 45°F.
- C. Do not work:
  - 1. Where Dust, Air-borne Particles, or Insects are present.
  - 2. Where Inclement Weather may damage Coating Surface.
  - 3. With less than 30 ft. candles of Available Light measured 3 ft. above adjacent Ground or Floor.

**1.12 EXTRA STOCK**

- A. Submit, in previously unopened Containers, 1 gallon of each color of each Top Coat.
- B. Label each Container with Product-identification and Use-location.
- C. Store on Project Premises where directed by Owner.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Products for each general purpose shall be of same Manufacturer. Do not use Products of different Manufacturers over one another, except for Shop Prime Coats specified in other Sections.

(Cont.)

**PART 2 - PRODUCTS**

**2.1 GENERAL (Cont.)**

- B. Products shall be free of Lead and Mercury and must comply with Federal VOC requirements.
- C. Products shall have good flowing and brushing properties and shall dry or cure free of Blemishes or Sags.
- D. Products shall not exceed Code-required Flame-spreads or Smoke-developments.

**2.2 GALVANIZED STEEL PRETREATMENT MATERIAL**

- A. Manufacturer & Brand: Amchem Galvaprep, Devoe Dev Prep 88, or approved.

**2.3 OTHER COATINGS**

- A. Products listed below in Paint Schedule shall comply with latest edition of Approved Products List published by Master Painters Institute (MPI). Copies can be obtained from Institute at (888) 674-8937, or they can be viewed by Computer at [www.paintinfo.com](http://www.paintinfo.com) and clicking-on either "Product Index Alphabetical" or "Product Index by MPI Number".
- B. Approved Manufacturers:
  - 1. Except for specific Products stipulated above, only those Manufacturers who maintain a full-time Local or Regional Architectural Representative are approved for use on this Project.
  - 2. Benjamin Moore, Devoe, Glidden Professional, Kelly Moore, Miller, Parker, Rodda, & Sherwin Williams are approved. Others may be approved if they attest to maintaining a full-time Representative.

**2.4 COLORS**

- A. Selected by Architect after Contract award.
- B. Manufacturers listed in Approved Products List are approved provided they can supply Colors that match selected Colors to Architect's satisfaction.

**2.5 MIXING & TINTING**

- A. Follow Manufacturer's instructions.
- B. Unless otherwise instructed by Manufacturer, deliver Coatings factory-mixed to Jobsite.
- C. Job-mix and Job-tint only when required by Manufacturer.
- D. Mix only in clean, rust-resistant Containers.
- E. Use Tinting Colors recommended by Coating Manufacturer.
- F. Where Thinner is used, do not exceed Coating Manufacturer's recommendations. Do not use Kerosene or Organic Solvents to thin Water-based Coatings.



**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Examine Surfaces to receive Coatings for existing conditions that could adversely effect Work execution, permanence, or quality. Give particular attention to Primer Coatings applied by other Trades.
- B. Verify that General Contractor has removed Door Hardware, as specified in Section 08-71-00.
- C. Do not apply Coating over Substrates which exceed the following Maximum Moisture Content:
  - 1. Wood: 15%
  - 2. Gypsum Board: 12%
- D. Prior to starting Work, notify General Contractor about defects requiring correction.
- E. Do not start Work until conditions are satisfactory. Applying Coatings to defective Substrates indicates acceptance of Defective Substrate by Painter, and Painter shall bear all costs to produce acceptable Work, including re-painting entire Surface (*No touch-up painting allowed.*).

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.
- B. Prior to painting, remove or otherwise protect any Finish Hardware, Accessories, Cover Plates, Lighting Fixtures, and similar Items. After painting, reinstall Removed Items and remove Protective Coverings.
- C. Do not dump Waste Materials, including Thinners, into Landscape Planting Beds, Plumbing Fixtures, or Storm Drains.
- D. Cover or otherwise protect Paint Storage and Mixing Rooms.

**3.3 FIRE PROTECTION**

- A. Take extraordinary care to prevent Fire.
- B. Open Coating Containers only when needed.
- C. Keep Rubbing Cloths and Oily Rags submersed in Water.

**3.4 SURFACE PREPARATION**

- A. General:
  - 1. Follow Coating Manufacturer's instructions.
  - 2. Remove any Loose Material, Dirt, Dust, or Foreign Matter.
- B. Gypsum Board:
  - 1. Repair any Holes, Cracks, Ridges, etc.; and smooth Repairs by sanding.
  - 2. Wipe-down or vacuum Surfaces to remove any residual Dust.

(Cont.)

**PART 3 - EXECUTION**

**3.4 SURFACE PREPARATION (Cont.)**

- C. Zinc Alloy & Galvanized Steel:
  - 1. Thoroughly clean with Solvent or pressure-wash with Detergent in hot Water.
  - 2. Etch Metal with Metal Conditioner or in accordance with Steel Structures Painting Council Specifications.
  - 3. Preparations to receive Enamel: ASTM D-6386
- D. Stainless Steel:
  - 1. Thoroughly clean with Solvent, or pressure-wash with Detergent in hot Water.
- E. All other Non-galvanized Ferrous Metal:
  - 1. Remove any Rust, Grease, Oil, or loose Scale.
- F. Aluminum:
  - 1. Etch with Phosphoric Acid, or approved.
- G. Wood Doors:
  - 1. Hand-block-sand Faces and Edges to remove any Handling Marks or Raised Grain. Do not use Steel Wool on Open-grain Species.
  - 2. Fill any Voids. At any Natural-finished Doors, color Filler to match Wood.
- H. Other Wood:
  - 1. Clean Soiled Surfaces with Alcohol, or approved.
  - 2. Remove any Mildew by scrubbing with Trisodium Phosphate Solution, treat with Bleach Solution, rinse with clean Water, and allow Surfaces to completely dry before proceeding with remaining work.
  - 3. Except any at Rough-sawn Surfaces, hand-block-sand Surfaces to remove any Raised Grain. Do not use Steel Wool on Open-grain Species.
  - 4. At Opaque Coatings seal any Knots, Pitch, and Resinous Sapwood before Primer Coat application.
  - 5. Fill any Voids, including set Nail and other Fastener Holes. At any Natural-finished Wood, color Filler to match Wood.
  - 6. Apply Clear Sealer-primer to any smooth-surfaced Softwood Species before applying any scheduled Penetrating Stain.

**3.5 COATING APPLICATION**

- A. General:
  - 1. Follow Coating Manufacturer's instructions.
  - 2. Do not apply initial Coating until Surface Moisture Content is within limitations recommended by Coating Manufacturer. Where in doubt test with Moisture Meter.
  - 3. Except as otherwise specified hereunder, apply Coatings with suitable Brush, Roller, or Spray Equipment recommended by Coating Manufacturer.
  - 4. Back-roll or brush-in spray-applied Primer Coats to assure Coating penetration.
  - 5. Maintain Brushes, Rollers, and Spray Equipment clean, free from contaminants, and suitably prepared for conditions of use.

(Cont.)

**PART 3 - EXECUTION**

**3.5 COATING APPLICATION (Cont.)**

**A. General: (Cont.)**

6. Do not exceed Coating Manufacturer's specified Coating Application Rate.
7. Follow Coating Manufacturer's recommended Drying Time between succeeding Coats.
8. Apply Finish Coats smooth, free of Brush Marks, Streaks, Laps, Coating Pile-up, and Skips.
9. Leave any Moldings and Ornaments clean, true to detail, and without excessive Coating build-up in Corners and Depressions.
10. Where Coating abuts other Materials or Colors cut Coating Edge clean, sharp, and with no overlap.
11. In addition to Door Faces, finish Door Tops, Bottoms, and Edges as specified below. If necessary, remove Doors from Frames.
12. Tint each Coat progressively lighter to enable confirmation of Coat quantities.
13. Sand and dust between each Coat to provide anchor for succeeding Coats, and to remove any Defects visible from 36 inch minimum distance.
14. Extend Paint Finish behind Mirrors and other similar Wall-mounted Items.
15. If and where recoating Existing Surface, apply New Coating over entire Existing Surface and extend New Coating to nearest Surface-break such as Wall Corners, Floor abutments, and Ceiling abutments.

**B. Painted Work:**

1. Woodwork: Immediately upon Jobsite delivery, prime all Surfaces including Concealed Surfaces.
2. Flat Metalwork, including Doors: Apply Paint with Roller or Airless Spray Equipment only. Do not apply by Brush.
3. If, and when, painting Door Hinges such as on Electrical Panels, open and close Doors several times after painting to prevent Paint bridging across Hinge Knuckles.
4. Roller-applied High-build Coatings: Do not "move" Paint with roller, or stop rolling prior to roller going dry. Remove roller marks by back-rolling, using minimum possible pressure, and rolling in 1 direction only.

**C. Transparent Finish Woodwork:**

1. Immediately upon Jobsite delivery, apply 1 coat of Clear Sealer-Primer to concealed surfaces of Wood, if any, to be installed at the following locations:
  - a. Building exterior
  - b. Within High Humidity areas
  - c. Adjacent to new Concrete
2. Adjust Finish Color where necessary to produce uniform appearance between adjacent Matching Materials.
3. At any Rough-textured Wood, back-brush any Spray-applied or Dip-applied Coating.

**PART 3 - EXECUTION**

**3.6 FIELD QUALITY CONTROL**

- A. Before proceeding with remaining Work, request Architect to inspect each first-finished Room, Space, and Item for acceptability.
- B. Immediately following application, Wet Film Thickness of Coatings may be tested in compliance with ASTM D-4414.
- C. After 14 calendar days following application, Coatings may be tested as follows:
  - 1. In compliance with ASTM D-4138, Dry Film Paint Thicknesses may be measured using a Mark II Tooke Coating Inspection Gage, or a similar Precision Instrument, designed for measuring Paint Coating Thicknesses. Touch-up Test Surface, which will measure approximately 1 sq. inch per Test.
  - 2. In compliance with ASTM D-3359 Tape Test, Coating Adhesion may be determined.
- D. Recoat any Work which fails Test.

**3.7 WASTE MANAGEMENT**

- A. Surplus Paint: Set aside for Owner's reuse, donate to organization such as Habitat for Humanity, or deliver to Re-manufacturer,
- B. Partly-used Paint Containers: Tightly-seal and store in protected, well-ventilated, fire-safe area maintained at moderate temperature, and designated for hazardous material storage.
- C. Do not dispose of Coatings, Solvents, or Cleaning Fluids by pouring onto Ground, into Toilets, or into Storm Drains. Place in suitable Containers and lawfully dispose.
- D. Hazardous Products (Paint, Stain, Wood Preservative Finish, Thinner, Solvent, etc.) are subject to disposal regulations. Comply with governing Federal, State, and Local requirements.
- E. When recycling is available, segregate and recycle Waste Materials. Treat Materials that cannot be recycled as Hazardous Waste and lawfully dispose.
- F. Appropriately launder Solvent-soaked and Oil-soaked Rags.
- G. Prior to disposal, dry Empty Material Containers

**3.8 PRODUCT CLEANING & REPAIRING**

- A. Remove any Spills, Splatters, and Stains including those in Paint Storage and Mixing Room.
- B. Unless otherwise approved, refinish entire Surface where portion of Coating is unacceptable.
- C. 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.
- D. Remove Debris from Project Site upon Work completion, or sooner if directed.

**PART 3 - EXECUTION**

**3.9 PROTECTING COMPLETED WORK**

- A. Post Signs and install Barricades where necessary to protect Completed Work of this Section against damage and discoloration.

**3.10 PAINTING SCHEDULE**

- A. General:
1. Prime Coats specified below may be omitted where Factory-applied Shop Coatings have been applied by other Trades.
  2. Quantities of Coats specified below are minimum. Finished Work shall be even, uniform, and free from cloudy and mottled appearance. Apply additional Coats (4 minimum) of any Deep or Bright Tone Colors where necessary to hide Substrate.
  3. Minimum Dry Film Thicknesses specified below include Prime Coat and Finish Coats combined.
- B. Surfaces not coated, unless otherwise indicated elsewhere:
1. Items having complete Factory-applied Finish
  2. Exterior Traffic Markings
  3. Irrigation System
  4. Plastic Laminate Covering
  5. Joint Sealants
  6. Factory-finished Wood Doors
  7. Finish Hardware
  8. Glass
  9. Acoustic Tile
  10. Flooring
  11. Roofing
  12. Seamless Floor Covering
  13. Visual Display Boards
  14. Toilet Compartments
  15. Cast Metal Plaque
  16. Signs
  17. Lockers & Locker Room Benches
  18. Operable Partitions
  19. Toilet & Bath Accessories
  20. Window Blinds
  21. Instructional Labels including Fire-resistance Rating Labels

(Cont.)

**PART 3 - EXECUTION**

**3.10 PAINTING SCHEDULE (Cont.)**

- C. Exterior Aluminum: & Stainless Steel:
  - 1. Latex Enamel
    - a. 1 coat Galvanized Primer (MPI Product #134 - *Min. Solids Volume 38% & Max. VOC 100 grams/liter*), followed by:
    - b. 2 coats Semi-gloss (MPI Level #5) Latex Enamel (MPI Product #11 - *Min. Solids Volume 39% & Max. VOC 50 grams/liter*)
    - c. Minimum Total Dry Film Thickness: 4.0 mils
- D. Exterior Galvanized Steel:
  - 1. Latex Enamel
    - a. 1 coat Galvanized Primer, (MPI Product #134 - *Min. Solids Volume 38% & Max. VOC 100 grams/liter*), followed by:
    - b. 2 coats Semi-gloss (MPI Level #5) Latex Enamel (MPI Product #11 - *Min. Solids Volume 39% & Max. VOC 50 grams/liter*)
    - c. Minimum Total Dry Film Thickness: 4.0 mils
- E. All Other Exterior Ferrous Metal:
  - 1. Latex Enamel
    - a. 1 coat Bonding Primer (MPI Product #107 - *Min. Solids Volume 38% & Max. VOC 100 grams/liter*), followed by:
    - b. 2 coats Semi-gloss (MPI Level #5) Latex Enamel (MPI Product #11 - *Min. Solids Volume 39% & Max. VOC 50 grams/liter*)
    - c. Minimum Total Dry Film Thickness: 4.0 mils
- F. Interior Gypsum Board in Restrooms:
  - 1. Latex Enamel
    - a. 1 coat Latex Primer (MPI Product #149), followed by:
    - b. 2 coats Semi-gloss (MPI Level #5) Latex Enamel (MPI Product #147)
    - c. Minimum Total Dry Film Thickness: 4.0 mils
- G. Interior Gypsum Board Elsewhere:
  - 1. Latex Enamel
    - a. 1 coat Latex Primer (MPI Product #149), followed by:
    - b. 2 coats Eggshell-gloss (MPI Level #3) Latex Enamel (MPI Product #145)
    - c. Minimum Total Dry Film Thickness: 4.0 mils
- H. Interior Ferrous Metal:
  - 1. Latex Enamel
    - a. 1 coat Rust Inhibiting Primer (MPI Product #107), followed by:
    - b. 2 coats Semi-gloss (MPI Level #5) Latex Enamel (MPI Product #147)
    - c. Minimum Total Dry Film Thickness: 4.0 mils

(Cont.)

**PART 3 - EXECUTION**

**3.10 PAINTING SCHEDULE (Cont.)**

- I. Interior Woodwork:
  - 1. Polyurethane Varnish
    - a. 1 coat Paste Filler (MPI Product #91) colored to match Wood, on Open-grained Woods only, followed by:
    - b. 1 coat Sanding Sealer (MPI Product #102 - *Min. Solids Volume 25% & Max. VOC 250 grams/liter*)
    - c. 3 coats Semi-gloss (MPI Level #5) Polyurethane Varnish (MPI Product #74 - *Min. Solids Volume 26% & Max. VOC 250 grams/liter*)
  - 2. Stain & Varnish
    - a. 1 coat Penetrating Oil Stain, (MPI Product #90 - *Min. Solids Volume 31% & Max. VOC 250 grams/liter*), followed by:
    - b. 1 coat Sanding Sealer (MPI Product #103) followed by:
    - c. 3 coats Semi-gloss (MPI Level #5) Polyurethane Varnish (MPI Product #74 - *Min. Solids Volume 26% & Max. VOC 250 grams/liter*)
  - 3. Latex Enamel
    - a. 1 coat Latex Primer (MPI Product #5 - *Min. Solids Volume 75% & Max. VOC 200 grams/liter*), followed by:
    - b. 2 coats Semi-gloss (MPI Level #5) Latex Enamel (MPI Product #147 - *Min. Solids Volume 38% & Max. VOC 50 grams/liter*)
    - c. Minimum Total Dry Film Thickness: 4.0 mils
- J. Custom-built Wood Casework:
  - 1. Wood Surfaces exposed when Doors & Drawers are closed:
    - a. Finish same as similar Interior Woodwork.
  - 2. Wood Door & Drawer Backs & Edges:
    - a. Finish same as exposed Cabinet surfaces.
  - 3. Casework Backs & Sides against Exterior Walls & Bottoms:
    - a. 1 thick coat Paint, Varnish, or Sealer.
    - b. No Surface without some type of Finish.
- K. Exposed Mechanical & Electrical Work:
  - 1. Exterior Metal, including Work on Roof & Utility Meter Box Bases:
    - a. Finish same as other Exterior Metal of same kind.

(Cont.)

**PART 3 - EXECUTION**

**3.10 PAINTING SCHEDULE (Cont.)**

- L. Interior Traffic Control Markings:
  - 1. Traffic Paint
    - a. 1 coat Traffic Paint (MPI Product #97)
    - b. Extent of Work: Paint Parking Stall Lines 4 inches wide, face and top of any painted curbs, and any other Pavement Markings shown on Drawings.
    - c. Colors:
      - 1. Parking Stall Lines, if any: White
      - 2. Driving Lane Dividers, if any: Yellow
      - 3. No Parking Zone Curbs, if any: Yellow
      - 4. No Parking Fire Lanes, if any: Red
      - 5. Pedestrian Crosswalk Lines, if any: White
      - 6. Accessible Vehicle Parking Symbols, if any: Blue & White
      - 7. Traffic Direction Arrows, if any: White
    - d. Minimum Total Dry Film Thickness: 9.0 mils

**END OF SECTION**



**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Gypsum Board to receive Boards: Section 09-25-00
- B. Signs: Section 10-44-00

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 SAMPLES**

- A. Submit samples showing Manufacturer's full range of Tackboard Fabric Facing standard Colors and Patterns for Architect's selection.
- B. Do not proceed until Colors have been selected.

**1.6 MAINTENANCE INSTRUCTIONS**

- A. In accordance with Section 01-83-00, submit Instructions to General Contractor for inclusion in Owner's Maintenance Manual.
- B. Install permanent Dry Marker Board Maintenance Instructions Plate mounted on, or adjacent to, 1 Board in each Room where Boards are installed. Plate shall include instructions for proper Board care.

**1.7 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Deliver in Protective Container with manufacturer's original, legible Label intact.
- B. Store in clean, dry area.
- C. Protect against damage and discoloration.
- D. Store Rolled Material on end and Sheet Material flat.
- E. Maintain Storage Area temperature above 55°F.

**PART 1 - GENERAL**

**1.8 ENVIRONMENTAL REQUIREMENTS**

- A. Maintain Installation Area temperature greater than 55°F for 24 hours prior to, during, and continuously after installation.
- B. When using offensive smelling Adhesives provide adequate ventilation to maintain healthy and pleasant Working Environment for Building Occupants.

**1.9 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**PART 2 - PRODUCTS**

**2.1 APPROVED MANUFACTURERS**

- A. Manufacturers listed herein are approved provided their Material matches selected Color and or Pattern to Architect's satisfaction at no additional cost to Owner.

**2.2 TACK BOARD**

- A. Manufacturer: Fabricmate (866) 622-2996, or approved.
- B. Core:
  - 1. Brand: ReCore
  - 2. Material: Impact-resistant and tackable Polyester Fiber
  - 3. Thickness: 1/2 inch
- C. Perimeter Trim:
  - 1. Style: FS100
  - 2. Type: Front-loading
  - 3. Color: Match adjacent Fabric Facing
- D. Facing Fabric:
  - 1. Manufacturer & Brand: Guilford (800) 544-0200, or approved.
  - 2. Brand: FR701
  - 3. Style: 2100
  - 4. Edges: Concealed
  - 5. Material: 100% recycled Polyester
  - 6. Color: Selected by Architect after Contract award from Manufacturer's standard choices.
- E. Extent of Work: Provide where located on Drawings.

**PART 2 - PRODUCTS**

**2.3 DRY MARKER BOARD**

- A. Manufacturer: US Markerboard (800) 791-2946, or approved.
- B. Brand: Infinity
- C. Material: White Glass magnetized to adhere Magnetic Devices
- D. Marker Pens:
  - 1. Type: Dry-wipe Ink
  - 2. Colors: Selected by Owner
  - 3. Quantity: 3 Pens plus 1 Eraser for each Room in which Dry Marker Boards are located
- E. Extent of Work: Provide where located on Drawings.

**2.4 METAL TRIM**

- A. General:
  - 1. Material: Extruded Aluminum
  - 2. Finish: Satin Mechanical with class II clear Anodic Coating matching AA-M31A31
  - 3. Minimum Thickness: 1/16 inch
- B. Perimeter Frames:
  - 1. Approximate Face Width: 1/2 inch
  - 2. Extent of Work: Except at Fabric-faced Tackboard, cover perimeter edges of Boards.
- C. Dry Marker Board Pen Holding Trough:
  - 1. Type: Open End
  - 2. Corners: Rounded or angled
  - 3. Extent of Work: Provide continuously across bottom of Dry Marker Boards.
- D. Accessories:
  - 1. Provide Tackable Cork Strip at top of Dry Marker Boards.
  - 2. Provide 4 Magnets for each Dry Marker Board:

**2.5 FASTENERS**

- A. Type: Phillips headed Screws
- B. Material & Finish: Match adjacent Surface
- C. Size: As required by conditions of use

**2.6 FABRICATION**

- A. Fabricate Boards full size and without Intermediate Joints, unless otherwise shown on Drawings or otherwise approved.
- B. If Intermediate Joints are approved, locate Joints no closer than 8 ft. apart and where approved.

(Cont.)

**PART 2 - PRODUCTS**

**2.6 FABRICATION (Cont.)**

- C. Fabricate Openings in Boards where necessary to receive any Electrical Boxes or other Penetrations through Boards.
- D. Remove any Backing Board Surface imperfections that would interfere with Board installation or mar Display Board appearance.
- E. Prime Backing Board Surface prior to applying Adhesive, where recommended by Adhesive Manufacturer.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Blocking and Surfaces to receive Boards are smooth, true, clean, sound, dry, secure, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 SURFACE PREPARATION**

- A. Remove any Wall Surface imperfections that could interfere with Board installation or mar Board appearance.

**3.4 INSTALLATION**

- A. General:
  - 1. Follow Manufacturer's instructions.
  - 2. Keep Perimeter Lines straight, plumb, level, and true to Wall Plane.
  - 3. Fit Board accurately and neatly around any Projections or Electrical Boxes.
  - 4. Fit any Butt Joints tight and in same plane on both sides of Joints.
  - 5. Secure Boards to Wall with Mechanical Fasteners only. Do not use Adhesive.

(Cont.)

**PART 3 - EXECUTION**

**3.4 INSTALLATION (Cont.)**

**B. Metal Trim:**

1. Provide Metal Trim around Board perimeter.
2. Locate Trim Joints no closer than 4 ft. o.c., unless otherwise approved.
3. Secure 24 inch o.c. maximum with Screws, unless otherwise approved.
4. Fit with precise Hairline Joints.
5. Remove any Burrs or sharp Edges.

**3.5 WASTE MANAGEMENT**

- A. Collect Cut-offs, Scrap, Shipping Pallets, Metal Strapping, & Packaging Waste; and place where directed for recycling.

**3.6 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Toilet Accessories: Section 10-80-00

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show layout dimensions, colors, methods of anchoring and reinforcing, core construction, and other pertinent details.

**1.6 SAMPLES**

- A. Submit in accordance with Section 01-33-00.
- B. Submit two 12x12 inch Compartment Color Samples.
- C. Obtain Architect's approval before ordering.

**1.7 REGULATORY REQUIREMENTS**

- A. Fabricate and install Compartments intended for use by Disabled Users in accordance with governing requirements of Americans with Disabilities Act.

(Cont.)

**PART 1 - GENERAL**

**1.8 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.
- B. Deliver in Manufacturer's original unopened and undamaged Packages.
- C. Clearly label Packages with Manufacturer's brand name, contents, color, stock number, and order number.
- D. Include Bolt Hole location Templates.

**1.9 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURER**

- A. Accurate, American Sanitary, Ampco, Flush-Metal, General, Global, Knickerbocker, Santana, or approved.
- B. Manufacturers listed above are approved for use provided their Material matches selected Color to Architect's satisfaction at no additional cost to Owner.

**2.2 SOLID PLASTIC TOILET COMPARTMENTS**

- A. Compartments:
  - 1. System Type: High-privacy
  - 2. Panel type: Flush
  - 3. Support: Floor to Ceiling Pilasters
- B. Material: High-density Polyethylene (HDPE) complying with NFPA 286
- C. Color: Selected by Architect from Manufacturer's standard choices.

**2.3 URINAL SCREENS**

- A. Manufacturer, Series, & Materials: Match adjacent Toilet Compartments
- B. Mounting Method: Wall-hung

**PART 2 - PRODUCTS**

**2.4 HARDWARE & FITTINGS**

- A. Material: Manufacturer's standard
- B. For Each Door:
  - 1. 1 pair self-lubricating, gravity type Hinges. Except at out-swinging Doors which shall close tightly, Hinges shall hold Door partially open when Compartment is unoccupied.
  - 2. 1 Coat Hook
  - 3. 1 Rubber Wall Bumper
  - 4. 1 ADA-compliant Paddle-type Latch with combination Stop & Latch Keeper
  - 5. 1 Pull on each face of out-swinging Doors
- C. Fasteners:
  - 1. Material: Corrosion-resistant
  - 2. Finish: Match Fittings

**2.5 FABRICATION**

- A. Accurately form to required sizes and shapes.
- B. Factory-prepare Cutouts and Drilled Holes to receive Compartment Hardware.
- C. Fabricate Panels, Doors, and Pilasters with concealed Reinforcement to receive Hardware, Fittings, and Accessories.
- D. Fabricate Panels, Doors, and Pilasters of single-piece without Joints or Seams.
- E. Dimensions:
  - 1. Compartments: See Drawings.
  - 2. Minimum clear dimension at Doors:
    - a. At Compartments serving Disabled Users: 32 inches
    - b. Elsewhere: 24 inches

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Blocking and Surfaces to receive Compartments are straight, plumb, square, secure, accurately sized and located, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.



**PART 3 - EXECUTION**

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 PREPARATORY WORK**

- A. Provide Structural Blocking within adjacent Wall Framing, if any, as required to secure Compartment and Urinal Screen installation.

**3.4 COMPARTMENT & SCREEN INSTALLATION**

- A. Install rigid, straight, parallel, plumb, and level in accordance with Manufacturer's instructions and approved Shop Drawings.
- B. Align closed Doors with adjacent Panel tops and bottoms.
- C. Prevent Pilaster Hangers from transmitting load to Ceiling.

**3.5 HARDWARE INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Provide no less than 2 Wall Brackets; locate near Panel top and bottom.
- C. Conceal evidence of field-drilling, cutting, and fitting.

**3.6 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.7 WASTE MANAGEMENT**

- A. Collect Cut-offs, Scrap, Shipping Pallets, Metal Strapping, & Packaging Waste; and place where directed for recycling.

**3.8 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.3 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.4 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show layout, dimensions, required clearances, details of construction, method of anchoring, and other pertinent items.

**1.5 SAMPLES**

- A. In accordance with Section 01-33-00, submit two 12 sq. inch minimum Samples of specified Metal finishes for Architect's approval.

**1.6 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.

**1.7 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**PART 2 - PRODUCTS**

**2.1 SCREENS**

- A. Manufacturer: RoofScreen Mfg. or approved.
- B. Profile: \_\_\_\_\_
- C. Material: Galvalume Steel
- D. Manufacturing Standard: ASTM A792
- E. Minimum Thickness: 24 gauge
- F. Finish:
  - 1. Material: PVDF Fluoropolymer baked-on Enamel
  - 2. Type: 79% solids
  - 3. Color:
    - a. Exterior Face: Selected after Contract award from Manufacturer's standard choices
    - b. Rear Face: White

**2.2 FASTENERS & ACCESSORIES**

- A. Material: Stainless Steel Match Louver
- B. Extent of Work: Provide all required.

**2.3 PROTECTIVE COATING**

- A. Manufacturer: Contractor's choice
- B. Type: Easily removable
- C. Extent of Work: Provide where necessary to protect exposed Metal against damage and discoloration.

**2.4 FABRICATION**

- A. Flat Surfaces: Smooth, true, and free from waves and buckles.
- B. Edges, Corners, & Angles: Clean, sharp, and square.
- C. Joints: Precision fitted without burrs.
- D. Allow for Material expansion and contraction.

(Cont.)

**PART 2 - PRODUCTS**

**2.5 WELDING**

- A. Employ Workmen experienced in welding Aluminum.
- B. Perform work carefully.
- C. Match adjacent color and finish.
- D. Fabricate Welds without porosity, cracks, and blow holes.
- E. Thoroughly fuse Welds without undercutting or overlapping.
- F. Grind exposed Welds smooth, and finish to match adjacent Material.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify the Surfaces to receive Louvers are accurately sized and located, sound, true, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 CORROSION PROTECTION**

- A. Coat contacting Dissimilar Materials with Corrosion Insulating Compound, 7-1/2 mil minimum dry film thickness, applied to each contacting face.

**3.4 INSTALLATION**

- A. Follow Manufacturer's instructions and approved Shop Drawings.
- B. Accurately position within 1/8 inch per ft. of specified location.
- C. Set plumb, level, square, and secure.

**3.5 WASTE MANAGEMENT**

- A. Collect Cut-offs, Scrap, Shipping Pallets, Metal Strapping, & Packaging Waste; and place where directed for recycling.

**PART 3 - EXECUTION**

**3.6 PRODUCT CLEANING & REPAIRING**

- A. After all Trades have completed their work, remove Protective Coverings and clean exposed Louver surfaces with plain Water, White Gasoline, or Distillate. Do not use Acid or Abrasive Cleaners.
- B. 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.
- C. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Gypsum Board Walls to receive Guards: Section 09-25-00

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show locations, dimensions, fabrication details, attachment methods, materials, colors, and other pertinent information.

**1.6 SAMPLES**

- A. Submit in accordance with Section 01-33-00.
- B. Include two 24 inch long Samples of each Guard.

**1.7 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.

**1.8 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**PART 2 - PRODUCTS**

**2.1 VERTICAL CORNER GUARDS**

- A. Manufacturer: Arden, Balco, C/S, IPC, Koroseal, Pawling, or approved.
- B. Model: Similar to C/S CO-8
- C. Mounting Method: Surface
- D. Material: Stainless Steel
- E. Length: Extend in single-piece from top of adjacent Wall Base for 48 inches.
- F. Required Accessory: Exposed End Caps matching adjacent Guard
- G. Extent of Work: Provide where shown on Drawings.

**2.2 HORIZONTAL WALL GUARDS**

- A. Manufacturer: Arden, Balco, C/S, IPC, Koroseal, Pawling, or approved.
- B. Model: Similar to C/S Acrovyn 4000
- C. Corners: Discontinuous
- D. Material: PVC-free Vinyl Resin
- E. UL Fire-resistance Class: 1
- F. Color: Selected by Architect after Contract award from Manufacturer's standard choices.
- G. Extent of Work: Provide where shown on Drawings.

**2.3 BLOCKING & BACKING**

- A. Provide all required where necessary for secure installation.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces to receive Guards are properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**PART 3 - EXECUTION**

**3.3 INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Secure Retainer Assemblies to Structural Backing.
- C. Install Guards plumb, level, straight, and true as applicable.

**3.4 WASTE MANAGEMENT**

- A. Collect Cut-offs, Scrap, Shipping Pallets, Metal Strapping, & Packaging Waste; and place where directed for recycling.

**3.5 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**



**SIGNS****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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Temporary Project Sign: Section 01-50-00
- B. Painted Traffic Control Markings: Section 09-90-00

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 SUBMITTALS**

- A. Prior to starting Work and in accordance with Section 01-33-00, submit the following for review and acceptance:
  - 1. Overall Sign Shapes, Sizes, Styles, Symbols, Graphic Layouts, Colors, Finishes, & Mounting.
  - 2. Material, Color, & Finish Samples for each Sign type
  - 3. 1 completed Sign of each type
  - 4. Layout and Mounting of each Sign type
- B. In accordance with Section 01-83-00, submit the following:
  - 1. Maintenance instructions for each Sign type.
  - 2. Ordering instructions for Replacement Parts and new Signs.

**1.6 REGULATORY AGENCY REQUIREMENTS**

- A. Signs shall comply with requirements specified in Americans with Disabilities Act Accessibilities Guidelines (ADAAG), published by the US Dept. of Justice.

(Cont.)

**SIGNS****PART 1 - GENERAL****1.7 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.
- B. Store any Adhesives at Room Temperature (55°F min.)

**1.8 ADVANCE NOTICES**

- A. Prior to enclosure of Wall and Ceiling Framing, notify General Contractor about Special Anchoring, Backing, and Blocking requirements for Signage.

**PART 2 - PRODUCTS****2.1 ROOM IDENTITY SIGNS**

- A. Manufacturer & Style: \_\_\_\_\_, or approved.
- B. Material: \_\_\_\_\_
- C. Background Color: \_\_\_\_\_
- D. Letter Color: \_\_\_\_\_
- E. Letter Height: \_\_\_\_\_
- F. Letter Style: \_\_\_\_\_
- G. Letter Case: \_\_\_\_\_
- H. Sign Length: 1 inch longer on each end than Sign wording
- I. Sign Height: 1/4 inch beyond each edge of Sign wording
- J. Special Requirement: Include Symbols and Braille Language where required by specified Regulatory Agency Requirements.
- K. Wording, Locations, & Quantities: See Drawings

**2.2 SIGN FABRICATION**

- A. Assemble in Shop where possible.
- B. Fabricate with tight, hairline, and smooth Joints.
- C. Ease Corners and Edges.
- D. Prohibit Surface Oil-canning, cupping, and other deflections.

(Cont.)

**SIGNS****PART 2 - PRODUCTS****2.3 GRAPHICS**

- A. General:
  - 1. Reproduce Graphic Elements, including Text & Symbols, from Computer-generated Digital Artwork.
  - 2. Produce with sharp Corners and Edges without pinholes, scratches, banding, or orange-peel texture.
- B. Braille & Tactile Size, Position, Spacing, Capitalization, & Profile Characteristics:
  - 1. Comply with specified Regulatory Agency Requirements.

**PART 3 - EXECUTION****3.1 EXISTING CONDITIONS**

- A. Verify that Backing and Surfaces to receive Signs are complete, clean, dry, secure, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Install plumb, level, square, and true as applicable.
- C. Secure to Substrate.

**3.4 WASTE MANAGEMENT**

- A. Collect Scrap and Packaging, and place where directed for recycling.

(Cont.)

**SIGNS****PART 3 - EXECUTION****3.5 PRODUCT CLEANING & REPAIRING**

- 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. Do not scratch or otherwise damage Sign surfaces.
- C. Remove Debris from Project Site upon Work completion, or sooner if directed.

**3.6 SIGN SCHEDULE**

- A. See Sign Schedule on Drawings.

**END OF SECTION**

**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 WORK BY OWNER**

- A. Locker Padlocks furnished and installed by Owner.

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Wood Curbing to support Lockers: Section 06-10-00

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.6 REGULATORY AGENCY REQUIREMENTS**

- A. Comply with American with Disabilities Act (ADA) Requirements.

**1.7 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show dimensions, details of construction, joining of Equipment to adjacent Construction, Color, and other pertinent Items.

**1.8 COLOR SAMPLES**

- A. Prior to ordering and in accordance with Section 01-33-00, submit 2 Samples of Manufacturer's Standard Colors for Architect's selection.

**PART 1 - GENERAL**

**1.9 INSTALLER'S QUALIFICATIONS**

- A. Employed by or acceptable to Manufacturer.

**1.10 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Deliver in Manufacturer's Protective Container with legible, identifying labels intact.
- B. Store flat and above ground.
- C. Protect against damage and discoloration.

**1.11 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**PART 2 - PRODUCTS**

**2.1 APPROVED MANUFACTURERS**

- A. Manufacturers listed herein are approved for use provided they match selected Color to Architect's satisfaction at no additional cost to Owner.

**2.2 LOCKER DIMENSIONS**

- A. Locker Dimensions listed below are nominal, are for each Unit, and are exclusive of any Base or Sloping Tops.

**2.3 STANDARD STEEL LOCKERS**

- A. Manufacturer: Interior, List, Lyon, Penco, Republic, or approved.
- B. Type: Single Tier
- C. Height: 72 inches
- D. Width: 15 inches
- E. Depth: 18 inches

(Cont.)

**PART 2 - PRODUCTS**

**2.3 STANDARD STEEL LOCKERS (Cont.)**

- F. Metal Thicknesses:
  - 1. Doors, Shelves, Bottoms. and any Exposed Tops: 16 ga.
  - 2. Exposed Ends, if any: 20 ga. (*Outer Panel to conceal Inner Panel Fasteners, Fabrication Holes, etc.*)
  - 3. Elsewhere: Manufacturer's standard.
- G. Finish:
  - 1. Material: Manufacturer's standard baked-on Enamel
  - 2. Color: Selected by Architect after Contract award from Manufacturer's standard choices

**2.4 NUMBER PLATES**

- A. Material: Non-corrosive
- B. Numbering: Sequentially number each Locker starting with "1".

**2.5 ACCESSORIES**

- A. Required:
  - 1. Coat Hooks
  - 2. Ventilation Louvers in Doors
  - 3. Top Shelves
  - 4. Sloping Tops
- B. Not Required:
  - 1. Finishing Strips for built-in Lockers
  - 2. Metal Legs
  - 3. Closed Metal Base

**2.6 HARDWARE**

- A. Door Lock: Hasp for Padlock, with Protective Armor Plate to prevent damage to Locker Paint by Padlock.
- B. Rubber Cushions: Provide for quiet Door operation.
- C. All Other: Manufacturer's standard type for conditions of use; provide all required.

(Cont.)

**PART 2 - PRODUCTS**

**2.7 LOCKER ROOM BENCHES**

- A. Benches:
  - 1. Material: Clear Hardwood
  - 2. Minimum Width: 9-1/2 inches
  - 3. Length: See Drawings
  - 4. Finish: 3 coats Satin-gloss Urethane Varnish as specified in Section 09-90-00
- B. Supports:
  - 1. Material: Steel
  - 2. Type: Manufacturer's standard
  - 3. Finish: Match Lockers
  - 4. Spacing: 1 ft. from each Bench end, and not more than 6 ft. apart between.
- C. Attachments:
  - 1. Material: Stainless Steel
  - 2. Type:
    - a. Bench to Support: Screws from Bench underside
    - b. Support to Floor: Expansion Bolts set in Lead Shields

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that surfaces to receive Work of this Section are solid, true, square, plumb, accurately sized and located, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Install plumb, true, rattle-free, and with uniform joints.
- C. Fasten securely together and to adjacent Construction.



**PART 3 - EXECUTION**

**3.4 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.5 WASTE MANAGEMENT**

- A. Collect Scrap and Packaging, and place where directed for recycling.

**3.6 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.3 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.4 DESIGN MODIFICATIONS**

- A. Prior to fabricating Partitions verify installation conditions, and if necessary, modify Partition System to accommodate Building design.
- B. No additional payment to Contractor for work of this type will be made.

**1.5 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show locations, opening sizes, stacking space, construction details, anchorage, required clearances, head and jamb details, hardware, facing pattern and color, and installation methods.

**1.6 SAMPLES**

- A. In accordance with Section 01-33-00, submit Partition Covering Samples prior to fabrication for Architect's selection.

**1.7 MANUFACTURER'S INSTRUCTIONS**

- A. In accordance with Section 01-83-00, submit Manufacturer's Operating and Maintenance Instructions to General Contractor for inclusion in Owner's Maintenance Manual.

**PART 1 - GENERAL**

**1.8 INSTALLER'S QUALIFICATIONS**

- A. Employed by or acceptable to Manufacturer.

**1.9 CERTIFICATES OF COMPLIANCE**

- A. For each Partition type, submit one copy of the following Independent Laboratory test results signed by Laboratory Official:
  - 1. Flame Spread Classification: ASTM E-84
  - 2. Sound Transmission Class: ASTM E-90 using 14x9 ft. minimum Test Opening. Operate Partitions 10 times minimum prior to Test.
- B. For each Partition type, submit one copy of the following signed by Building Official:
  - 1. Certification that Partition Systems comply with Seismic-force Restraint Requirements stipulated in governing Building Code.

**1.10 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Deliver in unopened crates with Manufacturer's legible label intact.
- B. Labels shall contain Manufacturer's name, product, and size.
- C. Protect against damage and discoloration.

**1.11 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**PART 2 - PRODUCTS**

**2.1 OPERABLE PARTITIONS**

- A. Manufacturer & Brand: Modernfold Acousti-Seal, or approved.
- B. Model: 932
- C. Type: Paired
- D. Operation: Manual
- E. Minimum Sound Transmission Classification (STC): 50
- F. Minimum ASTM E-152 Fire-resistance Rating: None required

(Cont.)

**PART 2 - PRODUCTS**

**2.1 OPERABLE PARTITIONS (Cont.)**

- G. Panels:
  - 1. Construction: Manufacturer's standard type
  - 2. Facing Material: Upholstery Fabric
  - 3. Maximum ASTM E-84 Flame-spread Rating: 25
  - 4. Facing Pattern & Color: Selected by Architect after Contract award from Manufacturer's standard choices
- H. Track & Trolley:
  - 1. Standard with Manufacturer; sized for loads; and designed for ease of operation, maintenance, and adjustment. Include any necessary Switches.
- I. Hardware:
  - 1. Pulls & Latches: Manufacturer's standard type
  - 2. Bottom Seal Operation: Automatic

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Opening to receive Partitions are square, plumb, accurately sized and located, and with level floor.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Accurately locate and secure in plumb position.

**3.4 ALLOWABLE INSTALLATION TOLERANCE**

- A. Set Horizontal Tracks level within 1/4 inch in 10 ft., non-accumulating.

**PART 3 - EXECUTION**

**3.5 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.6 WASTE MANAGEMENT**

- A. Collect Scrap and Packaging, and place where directed for recycling.

**3.7 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 EXTENT OF WORK**

- A. In accordance Drawings and Specifications, and in compliance with governing laws, regulations, codes, and requirements specified in Section 01-11-50; design, engineer, fabricate, and install Work of this Section, including System Supports & Attachments.

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Aluminum Entrance & Window Wall Systems to receive Screens: Section 08-40-00
- B. Joint Caulking & Sealing: Section 07-92-00

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 PERFORMANCE REQUIREMENTS**

- A. Support Design Loads listed in Structural Notes on Drawings.
- B. Withstand Thermal-expansion Stresses induced by up to 60°F temperature-shift without System buckling, fastener-damage, or other detrimental effects.

**1.6 REFERENCED SPECIFICATIONS**

- A. Comply with applicable portions of manufacturing and installation recommendations of American Architectural Manufacturer's Association, hereinafter referred to as AAMA; 1827 Walden Office Square; Suite 550; Schaumburg, IL 60173; (847) 303-5664.
- B. Copies can be obtained from Association.

(Cont.)

**PART 1 - GENERAL**

**1.7 CERTIFICATE OF COMPLIANCE**

- A. Submit certification, signed and sealed by Engineer registered to practice in Oregon, which stipulates that Work of this Section complies with Performance Requirements specified above.
- B. If Work, as specified herein and as shown on Drawings, is not capable of complying with Performance Requirements specified above, so notify Architect at least 5 working days prior to Contract-award date.

**1.8 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.9 INSTALLER'S QUALIFICATIONS**

- A. Employed by or acceptable to Manufacturer.

**1.10 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show construction, materials, profiles, thicknesses, dimensions, fasteners, supports, anchors, required clearances, and other pertinent details.

**1.11 PRODUCT DELIVERY**

- A. Coordinate with General Contractor's work schedule.

**1.12 PRODUCT STORAGE & HANDLING**

- A. Protect against damage and discoloration.

**1.13 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**SUN SHADES****PART 2 - PRODUCTS****2.1 SUN SHADES**

- A. Manufacturer: Dams, or approved
- B. Brand: Eggcrate
- C. Material: Extruded Aluminum
- D. Finish:
  - 1. Concealed Work: Mill finish
  - 2. Exposed Work:
    - a. Material: Fluoropolymer Enamel complying with AAMA 605.2
    - b. Manufacturer & Brand: Atochem Kynar 500, or approved.
    - c. Minimum Fluoropolymer: 70%
    - d. Minimum Dry Film Thickness: 1.2 mils
    - e. Color: Selected by Architect after Contract award

**2.2 STEEL REINFORCING**

- A. Manufacturing Standard: ASTM A-36

**2.3 FASTENERS**

- A. Type: Recommended by Manufacturer for conditions of use
- B. Material: Galvanically compatible with Adjacent Materials
- C. Finish:
  - 1. Where Exposed to View: Match Adjacent Material
  - 2. Where Concealed: Contractor's choice

**2.4 CORROSION INSULATING COMPOUND**

- A. Material: Asphaltic Coating Compound
- B. Manufacturing Standard: Fed. Spec. TT-C-494 type II

**2.5 CLOSURES, COVERS, TRIM, FLASHINGS, & ACCESSORIES**

- A. Provide Attachment Embeds, Panels, Connectors, Trim, etc. necessary for complete and secure installation.

(Cont.)



**SUN SHADES****PART 2 - PRODUCTS****2.6 FABRICATION**

- A. Comply with applicable portions of Referenced Specifications.
- B. Provide concealed Steel Reinforcement where indicated or required to resist Wind or other Applied Loads.
- C. Fabricate Connections as required for strength and rigidity using concealed Mechanical Fastenings wherever possible. Where not possible, welding may be used.
- D. Match exposed Welds with adjacent Material, free of porosity, cracks, and blow-holes.
- E. Select Materials carefully for matching Color and Texture after finishing.
- F. Fabricate Flat Surface smooth and true, and free from waves, buckles, and seams.
- G. Fabricate Edges, Corners, and Angles clean, sharp, and square.
- H. Fit Members with hairline, virtually invisible joints.
- I. Allow for expansion and contraction.
- J. Prevent Noise resulting from thermally-induced Material movement, Vibration harmonics, or Wind passage.

**PART 3 - EXECUTION****3.1 EXISTING CONDITIONS**

- A. Verify that Structure to receive Work of this Section is plumb, rigid, accurately sized and located, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 CORROSION PROTECTION**

- A. Coat contacting Dissimilar Materials with Corrosion Insulating Compound, 7-1/2 mil dry film thickness, minimum, applied to each Contacting Face.

**3.4 INSTALLATION**

- A. Follow Manufacturer's instructions, approved Shop Drawings, and applicable portions of Referenced Specifications.
- B. Install level, square, true, rigid, secure, and in alignment with adjacent Other Work.

**PART 3 - EXECUTION**

**3.5 ALLOWABLE INSTALLATION TOLERANCES**

- A. Member Alignment: True within 1/8 inch per 12 feet.
- B. Sunshade Panel Squareness: 1/8 inch maximum difference between opposite Diagonal Measurements.

**3.6 TOUCH-UP PAINTING**

- A. Touch-up any exposed Metal Finish damaged by cutting. Match adjacent Finish.

**3.7 PRODUCT CLEANING & REPAIRING**

- A. Remove Protective Coatings.
- B. Including Work of other Trades, clean, repair and touch-up, or replace when directed,
- C. Products which have been soiled, discolored, or damaged by work of this Section.
- D. Collect Cut-offs and Scrap, and place where directed for recycling.
- E. Remove Debris from Project Site upon work completion or sooner, if directed.

**END OF SECTION**

**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Mirrors: Section 08-80-00
- B. Toilet Compartments to receive Accessories: Section 10-16-00
- C. Electrical Conduit & Wiring for Warm Air Dryers: See Electrical Specifications

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 MANUFACTURER'S LITERATURE**

- A. In accordance with Section 01-33-00, show Rough Opening and Installation Details.
- B. Manufacturer's standard drawings may be used, provided required information is shown.

**1.6 REGULATORY AGENCY REQUIREMENTS**

- A. Accessories shall comply with applicable requirements of Americans with Disabilities Act (ADA)

**1.7 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.
- B. Do not remove Protective Covers until final Project clean-up.
- C. Deliver Accessory Keys to Architect for forwarding to Owner.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Approved Manufacturers & Models:
  - 1. Unless otherwise indicated, Manufacturers and Model Numbers listed below are selected from Bobrick Catalog, which are approved for use. Comparable Products by American Specialties, Bradley, McKinney/Parker, and TSM are also approved.
  - 2. Products by other Manufacturers may be approved in accordance with requirements specified in Section 01-63-00.
- B. Prior to ordering Products:
  - 1. Verify type of Paper to be used by Owner.
  - 2. Verify types and thicknesses of Wall Construction. Provide all required Fasteners, Clamps, Adapters, etc. necessary for conditions encountered.

**2.2 TOILET PAPER DISPENSERS**

- A. Manufacturer & Model: Bobrick B-4288, or approved.
- B. Type: Single Roll with automatically positioned Spare Roll
- C. Material: Stainless Steel
- D. Mounting: Surface
- E. Extent of Work: Provide 1 adjacent to each Toilet.

**2.3 PAPER TOWEL DISPENSERS**

- A. Manufacturer & Model: Bobrick B-4262, or approved.
- B. Type: Hinged, with Sloping Top, and equipped to dispense C-fold and Multi-fold Towels.
- C. Material: Stainless Steel
- D. Mounting: Surface
- E. Extent of Work: Provide where located on Drawings as follows:
  - 1. 1 in Kitchen
  - 2. 1 adjacent to each Hand Washing Sink in Shop

**2.4 COMBINATION PAPER TOWEL DISPENSERS & WASTE DISPOSALS**

- A. Manufacturer & Model: Bobrick \_\_\_\_\_, or approved.
- B. Type: Equip to dispense C-fold and Multi-fold Towels.
- C. Material: Stainless Steel
- D. Mounting: Semi-recessed
- E. Extent of Work: Provide 1 in each Rest Room.

**PART 2 - PRODUCTS**

**2.5 WASTE DISPOSALS**

- A. Manufacturer & Model: Bobrick B-275, or approved.
- B. Lining: Removable Plastic Bag
- C. Material: Stainless Steel
- D. Mounting: Surface
- E. Extent of Work: Provide 1 adjacent to each Hand Washing Sink in Shop.

**2.6 WARM AIR DRYERS**

- A. Manufacturer & Model: Saniflow Dualflow Plus, or approved.
- B. Required Accessory: KITDESM14A for direct-drainage to Waste Line
- C. Extent of Work: Provide in Men's & Women's Rest Rooms.

**2.7 LIQUID SOAP DISPENSERS**

- A. Manufacturer & Model: Bobrick B-822, or approved.
- B. Mounting: Through Basin Rim
- C. Extent of Work: Provide 1 at each Lavatory Sink.

**2.8 TOILET SEAT COVER DISPENSERS**

- A. Manufacturer & Model: Bobrick B-4221, or approved.
- B. Type: Flat Sheet
- C. Material: Stainless Steel
- D. Mounting: Surface
- E. Extent of Work: Provide 1 adjacent to each Toilet.

**2.9 SANITARY NAPKIN DISPOSALS**

- A. Manufacturer & Model: Bobrick B-270, or approved.
- B. Door Type: Hinged Top Cover and bottom Trap Door
- C. Material: Stainless Steel
- D. Mounting: Surface
- E. Extent of Work: Provide 1 adjacent to each Women's & Unisex Toilet.

(Cont.)

**PART 2 - PRODUCTS**

**2.10 GRAB BARS**

- A. Manufacturer & Model: B-6806, or approved.
- B. Material: Satin-finish Stainless Steel
- C. Wall Clearance: 1-1/2 inches
- D. At each Unisex Toilet & at each Toilet intended for Disabled Users:
  - 1. Quantity: 3 Bars per Toilet
  - 2. Horizontal Bars Mounting Height above Floor: 33 inches
  - 3. Length:
    - a. At Toilet Side:
      - 1. Horizontal Bar: 42 inches (**Space 12 inches away from Rear Wall**)
      - 2. Vertical Bar: 18 inches (*Extend vertically from front-end of Horizontal Bar*)
    - b. At Toilet Rear: 36 inches (*Extend 12 inches beyond Toilet centerline toward nearest side wall and extend 24 inches beyond Toilet centerline toward open side of Toilet.*)

**2.11 HOOKS**

- A. Manufacturer & Model: Bobrick B-6727, or approved.
- B. Type: Double Hook
- C. Material: Stainless Steel
- D. Mounting Height above Floor, unless otherwise shown on Drawings: 54 inches
- E. Extent of Work: Provide 1 in each Unisex Restroom where shown on Drawings.

**2.12 SHOWER CURTAIN RODS**

- A. Manufacturer & Model: Bobrick B-6047, or approved.
- B. Material: Stainless Steel
- C. Length: Fit Opening
- D. Required Accessories:
  - 1. Rod Mounting Flanges
  - 2. Snap Hooks with Nylon Rollers spaced at 6 inch centers.
- E. Extent of Work: Provide 1 at each Shower.

**2.13 SHOWER CURTAINS**

- A. Manufacturer & Model: Bobrick 204-2, or approved.
- B. Material: Opaque matte-white Vinyl
- C. Size: Fit Opening
- D. Extent of Work: Provide 1 at each Shower.

**PART 2 - PRODUCTS**

**2.14 FASTENERS**

- A. Non-corrosive type recommended by Accessory Manufacturer.

**2.15 BLOCKING & BACKING**

- A. Provide all necessary.
- B. Accessories are located on Drawings for Contractor's convenience.
- C. Verify location, type, and quantity with Owner prior to proceeding with Work.

**2.16 FABRICATION**

- A. Fabricate Units with welded Corners, one-piece seamless exposed Flanges, and with no open Miters.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Do not proceed until Blocking and Surfaces to receive Accessories are smooth, clean, dry, square, sound, accurately sized and located, painted, and otherwise properly prepared.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. If Mounting Locations are not specified herein, or shown on Drawings, locate where directed by Architect.
- B. Follow Manufacturer's installation instructions.
- C. Mount plumb, level, true, and secure.

**PART 3 - EXECUTION**

**3.4 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.5 WASTE MANAGEMENT**

- A. Collect Scrap and Packaging, and place where directed for recycling.

**3.6 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**



**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Roof Accessories: Section 07-72-00
- B. Door Hardware: Section 08-71-00
- C. Field Painting: Section 09-90-00
- D. Visual Display Boards: Section 10-10-00
- E. Toilet Compartments: Section 10-16-00
- F. Wall & Corner Guards: Section 10-26-00
- G. Signs: Section 10-44-00
- H. Lockers: & Locker Room Benches: Section 10-50-00
- I. Operable Partitions: Section 10-65-00
- J. Toilet Accessories: Section 10-80-00
- K. Appliances: Section 11-45-20
- L. Equipment: Division 11
- M. Window Blinds: Section 12-51-00

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 SHOP DRAWINGS**

- A. Show layout, dimensions, details of construction, methods of joining to other Work, required clearances, finishes, accessories, and other pertinent items.
- B. In accordance with Section 01-33-00, submit for the following:
  - 1. Fire Extinguisher Cabinets
  - 2. Bicycle Racks
  - 3. Projection Screens
  - 4. Phone Booths
- C. Manufacturer's standard Printed Literature may be substituted provided required information is included.

**PART 1 - GENERAL**

**1.6 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.
- B. Deliver in Manufacturer's original, unopened, protective wrapping with original, legible label intact.

**1.7 INSTALLER'S QUALIFICATIONS**

- A. Employed by or acceptable to Manufacturer of Specialty being installed.

**PART 2 - PRODUCTS**

**2.1 FIRE EXTINGUISHER CABINETS**

- A. Manufacturer: J.L. Industries, Larsen's, Modern Metal Products, Potter-Roemer, or approved.
- B. Model: Similar to J.L. Industries Clear Vu
- C. Minimum ASTM E-814 Fire-resistive Construction: 1 hour
- D. Size: Accommodate Fire Extinguishers specified below
- E. Mounting: Semi-recessed and flat trimmed
- F. Door & Frame Material: Stainless Steel
- G. Door Glazing: Clear Acrylic Plastic convex Bubble
- H. Cylinder Lock: Not Required
- I. Cabinet Interior: Black enamel
- J. Extinguisher Support: Manufacturer's standard Brackets to receive Fire Extinguishers specified below
- K. Extent of Work: Provide where shown on Drawings.

**2.2 FIRE EXTINGUISHERS**

- A. Manufacturer: Contractor's choice.
- B. Type: OSHA-approved and UL-rated for type A, B, & C fires
- C. Color: Red
- D. Size: 5 lb. 10 lb.
- E. Fill and service Extinguishers prior to Project Substantial Completion. Attach Certificate of Service, including date, to each Extinguisher.
- F. Extent of Work: Provide Extinguishers within each Extinguisher Cabinet specified above.

**PART 2 - PRODUCTS**

**2.3 COVER SLEEVES FOR PIPE BOLLARDS**

- A. Manufacturer & Type: Ideal Shield, (866) 825-8659, Innoplast (800) 526-9287, or approved.
- B. Material: Polyethylene
- C. Minimum Wall Thickness: 1/4 inch
- D. Color: Yellow
- E. Size: Fit Pipe Bollard specified in Section 05-50-00.
- F. Mounting: Bolt-in
- G. Extent of Work: Cover each Pipe Bollard specified in Section 05-50-00.

**2.4 SPLASH BLOCKS**

- A. Material: Precast Concrete
- B. Approximate Size: 12x24 inches
- C. Finish: Manufacturer's Standard
- D. Extent of Work: Provide 1 beneath each Sheetmetal Downspout discharging Rainwater onto Roof.

**2.5 TELEPHONE BOOTHS**

- A. Manufacturer: Room, or approved.
- B. Brand: Phone Booth
- C. Color: Selected by Architect after Contract award from Manufacturer's standard choices
- D. Extent of Work: Provide in Open Offices where shown on Drawings.

**2.6 CLOSET WIRE SHELVING**

- A. Manufacturer: Schulte (800) 669-3225, or approved.
- B. Brand: Adjustable Lifetime Ventilated Shelving System with Hanging Rods
- C. Type: Heavy duty
- D. Minimum Load Capacity: 75 lbs. per lin. ft.
- E. Material: 0.0915 inch diameter Steel Wire spaced 1/2 inches o.c.
- F. Finish: Electrostatic-applied and oven-cured 5-mil thick Nickel-finish
- G. Required Accessories: Hanging Rails, Support Brackets, Attaching Devices, Fasteners, and any others required for complete and structurally sound installation.
- H. Layout & Dimensions: See Drawings

(Cont.)

**PART 2 - PRODUCTS**

**2.7 PROJECTION SCREENS**

- A. Manufacturer: Draper, Da-Lite, or approved.
- B. Model: Similar to Draper Envoy
- C. Size: \_\_\_\_\_
- D. Mounting: Recessed above Ceiling
- E. Operation: Manual
- F. Extent of Work: Provide in Multi Purpose Rooms where shown on Drawings.

**2.8 BICYCLE RACKS**

- A. Manufacturer: Huntco, or approved.
- B. Style: Tilikum
- C. Pipe Shape: Round
- D. Securing Method: Bolted to Substrate
- E. Material: Stainless Steel
- F. Extent of Work: Provide where shown on Drawings.

**2.9 SHOP PAINT**

- A. Unless herein specified otherwise, factory-apply one coat Rust inhibiting Primer as specified in Section 09-90-00 to Ferrous Metal surfaces after fabrication, but before installation.
- B. Substitute complete Factory-Finish where so specified herein.

**2.10 BLOCKING & BACKING**

- A. Provide where necessary.
- B. Specialties are shown on Drawings for Contractor's convenience. Verify location, type, and extent of Work before installing Blocking and Backing.

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Blocking, Backing, and Surfaces to receive Specialties are properly prepared, sized, and located.
- B. Prior to starting Work notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**PART 3 - EXECUTION**

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect other materials against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. General:
1. Follow Manufacturer's instructions and approved Shop Drawings.
  2. Secure Specialties plumb, level, square, and true as applicable.
- B. Fire Extinguisher Cabinets:
1. Unless otherwise shown on Drawings, mount Cabinet so that Extinguisher top is 48 inches above Floor.
- C. Fire Extinguishers:
1. Mount in Fire Extinguisher Cabinets.
- D. Splash Blocks:
1. Locate directly under Downspout.
  2. Seat level and secure.
- E. Pipe Bollard Sleeves:
1. Slide over Pipe Bollard, and anchor securely in place as instructed by Sleeve Manufacturer.
- F. Phone Booths:
1. Anchor to adjacent construction as recommended by Manufacturer.
  2. Make Utility connections
- G. Bicycle Racks:
1. Anchor to adjacent construction as recommended by Manufacturer.
- H. Projection Screens
1. Anchor to adjacent construction as recommended by Manufacturer.
- I. Wire Shelving:
1. Unless otherwise shown on Drawings, mount on Brackets 5 ft. above Floor.

**3.4 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.5 WASTE MANAGEMENT**

- A. Collect Scrap and Packaging, and place where directed for recycling.

**PART 3 - EXECUTION**

**3.6 CLEANING & REPAIRING**

- A. Remove Debris from Project Site upon Work completion, or sooner if directed.
- 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.
- C. Leave installation clean and defect-free.

**END OF SECTION**

**OWNER-FURNISHED EQUIPMENT INSTALLATION****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 EXTENT OF WORK**

- A. Install Owner-furnished Equipment where Equipment is identified on Drawings as "OFCI" (*Owner-furnished Contractor-installed*).

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Mechanical Piping, Electrical Conduit & Wiring, and connections if any, to Items specified herein: See Mechanical & Electrical Specifications

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.6 MANUFACTURER'S LITERATURE**

- A. Prior to Equipment installation, Owner will supply for Contractor's use, detailed information showing Equipment dimensions, required clearances, methods of joining Equipment to other Work, utility locations, and other pertinent information.

**1.7 INSTALLER'S QUALIFICATIONS**

- A. Acceptable to Equipment Manufacturer.

**1.8 PRODUCT DELIVERY**

- A. Owner will deliver Products as stipulated in Section 01-11-00.

**OWNER-FURNISHED EQUIPMENT INSTALLATION****PART 1 - GENERAL****1.9 PRODUCT STORAGE & HANDLING**

- A. Protect against damage and discoloration.

**1.10 FIELD MEASUREMENTS**

- A. Verify prior to installing Equipment.
- B. If field measurements differ slightly from Drawing dimensions, modify adjacent Construction as required for accurate fit. If measurements differ substantially, notify Architect prior to installing Equipment.

**PART 2 - PRODUCTS****2.1 EQUIPMENT TO BE INSTALLED**

- A. Identified on Drawings as “OFCI” (*Owner-furnished Contractor-installed*).

**2.2 ACCESSORIES**

- A. Equipment will be delivered complete with necessary Accessories including Utility Connection Devices.

**2.3 BLOCKING & BACKING**

- A. Provide where necessary.
- B. Equipment shown on Drawings is located for Contractor's convenience. Before installing Blocking and Backing, verify Equipment type, location, and extent of Work.

**PART 3 - EXECUTION****3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces to receive Equipment are properly prepared.
- B. Verify that any necessary Mechanical and Electrical Utilities are accurately installed.
- C. Prior to starting Work, notify General Contractor about defects requiring correction.
- D. Do not start Work until conditions are satisfactory.



**OWNER-FURNISHED EQUIPMENT INSTALLATION****PART 3 - EXECUTION****3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Position plumb, level, square, straight, and true as applicable.
- C. Securely anchor to adjacent Construction.
- D. Make Utility connections.

**3.4 ADJUSTMENTS**

- A. Adjust any Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.5 WASTE MANAGEMENT**

- A. Collect Metal Strapping & Packaging Waste, and place where directed for recycling.

**3.6 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon work completion or sooner, if directed.

**END OF SECTION**

**APPLIANCES****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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Plumbing Piping for Appliances: See Plumbing Specifications
- B. Electrical Conduit & Wiring for Appliances: See Electrical Specifications

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 MANUFACTURER'S LITERATURE**

- A. Submit in accordance with Section 01-33-00.
- B. Show dimensions, required clearances, methods of joining to other Work, Utility locations, and other pertinent information.
- C. Manufacturer's Printed Data may be submitted provided required information is included.

**1.6 CERTIFICATE OF COMPLIANCE**

- A. Furnish Certificate from Manufacturer stating that Appliances, where so required, meet or exceed EPA Energy Star Standards. In lieu of submitting Certificate, Manufacturer may affix Certifying Label on each Unit.

**1.7 OPERATING & MAINTENANCE DATA**

- A. In accordance with Section 01-83-00, submit to General Contractor for inclusion in Owner's Maintenance Manual.

**APPLIANCES****PART 1 - GENERAL****1.8 REGULATORY AGENCY REQUIREMENTS**

- A. Appliances must be approved by Underwriters Laboratories, or approved.

**1.9 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.

**1.10 FIELD MEASUREMENTS**

- A. Verify prior to ordering Appliances.  
B. If field measurements differ slightly from Drawing dimensions modify adjacent Construction as required for accurate fit. If measurements differ substantially, notify Architect prior to ordering Appliances.

**1.11 WARRANTY**

- A. Work specified herein subject to warranty terms specified in Contract Conditions.

**PART 2 - PRODUCTS****2.1 REFRIGERATOR**

- A. Manufacturer: \_\_\_\_\_, or approved.  
B. Model: \_\_\_\_\_  
C. Type: Frost Free  
D. Energy Efficiency: Meet or exceed EPA Energy Star standards  
E. Face Material: Stainless Steel  
F. Extent of Work: Provide where shown on Drawings.

**2.2 MICROWAVE OVEN**

- A. Manufacturer: \_\_\_\_\_, or approved.  
B. Model: \_\_\_\_\_  
C. Energy Efficiency: Meet or exceed EPA Energy Star standards  
D. Type: Built-in  
E. Face Material: Stainless Steel  
F. Extent of Work: Provide where shown on Drawings.

**APPLIANCES****PART 2 - PRODUCTS****2.3 GARBAGE DISPOSAL**

- A. Manufacturer: \_\_\_\_\_, or approved.
- B. Model: \_\_\_\_\_
- C. Extent of Work: Provide at Kitchen Sink Drain.

**2.4 DISHWASHER**

- A. Manufacturer: \_\_\_\_\_, or approved.
- B. Model: \_\_\_\_\_
- C. Energy Efficiency: Meet or exceed EPA Energy Star standards
- D. Type: Built-in
- E. Face Material: Stainless Steel
- F. Extent of Work: Provide where shown on Drawings.

**2.5 REQUIRED ACCESSORIES**

- A. Provide Appliances complete with all necessary Accessories including, but not limited to, the following:
  - 1. Anchor Bolts
  - 2. Utility Connection Devices

**2.6 BLOCKING & BACKING**

- A. Provide where necessary.
- B. Appliances are located on Drawings for Contractor's convenience. Before installing Blocking and Backing, verify exact Appliance location.

**PART 3 - EXECUTION****3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces to receive Appliances are properly located, sized, and prepared.
- B. Verify that Utilities are accurately installed.
- C. Prior to starting Work, notify General Contractor about defects requiring correction.
- D. Do not start Work until conditions are satisfactory.

**APPLIANCES****PART 3 - EXECUTION****3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Secure Appliances plumb, level, square, straight, and true as applicable.
- C. Make all Utility connections.

**3.4 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.5 WASTE MANAGEMENT**

- A. Collect Metal Strapping & Packaging Waste, and place where directed for recycling.

**3.6 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 PRODUCTS FURNISHED, BUT INSTALLED UNDER OTHER SECTIONS**

- A. Anchor Bolts and necessary Setting Templates.

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show dimensions, required clearances, methods of joining to other Work, utility locations, and other pertinent information.

**1.6 OPERATING & MAINTENANCE DATA**

- A. In accordance with Section 01-83-00, submit to General Contractor for inclusion in Owner's Maintenance Manual.

**1.7 INSTALLER'S QUALIFICATIONS**

- A. Employed by or acceptable to Equipment Manufacturer.

**1.8 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.

**PART 1 - GENERAL**

**1.9 FIELD MEASUREMENTS**

- A. Verify prior to ordering Equipment.
- B. If field measurements differ slightly from Drawing dimensions, modify adjacent Construction as required for accurate fit. If measurements differ substantially, notify Architect prior to ordering Equipment.

**PART 2 - PRODUCTS**

**2.1 PASS-THRU EQUIPMENT**

- A. Manufacturer: \_\_\_\_\_, or approved.
- B. Model: \_\_\_\_\_
- C. Material: \_\_\_\_\_
- D. Required Optional Equipment: \_\_\_\_\_
- E. Extent of Work: See Drawings

**2.2 REQUIRED ACCESSORIES**

- A. Provide Equipment complete with all necessary Accessories including, but not limited to, the following:
  - 1. Anchor Bolts
  - 2. Utility Connection Devices

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces to receive Equipment are properly prepared.
- B. Verify that Electrical Utilities are accurately installed.
- C. Prior to starting Work, notify General Contractor about defects requiring correction.
- D. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**PART 3 - EXECUTION**

**3.3 INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Position plumb, level, square, straight, and true as applicable.
- C. Securely anchor to adjacent Construction.
- D. Make all Utility connections.

**3.4 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.5 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon work completion or sooner, if directed.

**3.6 WASTE MANAGEMENT**

- A. Collect Metal Strapping & Packaging Waste, and place where directed for recycling.

**3.7 OPERATING & MAINTENANCE DEMONSTRATIONS**

- A. In accordance with Section 01-83-00, Personally instruct Owner's Representative in proper operation and maintenance methods.

**END OF SECTION**



**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 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Electrical Conduit Wiring and connections: Electrical Specifications

**1.3 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.4 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.5 MANUFACTURER'S LITERATURE**

- A. Submit in accordance with Section 01-33-00.
- B. Show dimensions, methods of joining to other Work, utility locations, and other pertinent information.
- C. Manufacturer's Printed Data may be substituted provided required information is included.

**1.6 INSTALLER'S QUALIFICATIONS**

- A. Employed by or acceptable to Case Manufacturer.

**1.7 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.

(Cont.)

**PART 2 - PRODUCTS**

**2.1 DISPLAY CASE**

- A. Manufacturer: \_\_\_\_\_, or approved.
- B. Model: \_\_\_\_\_
- C. Material: \_\_\_\_\_ and Glass
- D. Extent of Work: See Drawings

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Surfaces to receive Case is properly prepared.
- B. Verify that Electrical Utilities are accurately installed.
- C. Prior to starting Work, notify General Contractor about defects requiring correction.
- D. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Position plumb, level, square, straight, and true as applicable.
- C. Securely anchor to adjacent Construction.
- D. Make all Utility connections.

**3.4 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.5 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon work completion or sooner, if directed.

**PART 3 - EXECUTION**

**3.6 WASTE MANAGEMENT**

- A. Collect Metal Strapping & Packaging Waste, and place where directed for recycling.

**END OF SECTION**

**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 EXTENT OF WORK**

- A. Provide Shades over interior face of all Exterior Windows & Glazed Doors, except at Building Entries.

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Shower Curtains: Section 10-80-00

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.6 INSTALLER'S QUALIFICATIONS**

- A. To be eligible to perform Work specified herein Installer must have successfully completed at least 2 similar projects, and be employed by or acceptable to Manufacturer.

**1.7 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.
- B. Deliver in Manufacturer's original, unopened, undamaged Packages with legible Labels intact.
- C. Identify Manufacturer, brand name, finish, color, and installation location on each Package.

(Cont.)

**PART 1 - GENERAL**

**1.8 FIELD MEASUREMENTS**

- A. Verify prior to fabrication.
- B. If field measurements differ slightly from Drawing dimensions modify Work as required for accurate fit. If measurements differ substantially, notify Architect prior to fabrication.

**PART 2 - PRODUCTS**

**2.1 ROLLER SHADES**

- A. Manufacturer: MechoShade, (800) 437-6360, or approved.
- B. Operation: Manually-operated Chain
- C. Fabric: Non-PVC EcoVeil Shade Cloth
- D. Openness Factor: 3%
- E. Color: Selected by Architect after Contract award from Manufacturer's standard choices

**2.2 FABRICATION**

- A. General:
  - 1. Fabricate each Shade as complete Unit produced by one Manufacturer, including all necessary Hardware, Mounting Devices, Accessory Items, and Fasteners.
  - 2. Fabricate Units to completely fill Opening from Jamb to Jamb and Head to Sill.
  - 3. Align any intermediate Unit Ends with any adjacent Vertical Window Mullions.
  - 4. Locate Controls for easy operation. Notify Architect before fabrication if indicated locations can be improved.
  - 5. Locate Bottom Bar 1/4 inch clear of Window Sill.
  - 6. At any Openings requiring continuous multiple Shade Units with separate Rollers, abut adjacent Roller Joints and align Joints at center of Window Mullions.
- B. At Blinds installed on Doors:
  - 1. Secure Blind bottoms to Door with Hooks to prevent Blinds swaying while Doors are in motion.

(Cont.)

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Verify that Work Surfaces are accurately located and secure.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Do necessary cutting, tapping, and drilling.
- C. Provide necessary clearance to permit unencumbered Sash Hardware and Door Hardware operation.
- D. Protect Metal Parts in contact with Dissimilar Materials against galvanic corrosion.
- E. Securely attach Units plumb, square, and true with Brackets, Clips, and Fasteners.

**3.4 ADJUSTMENTS**

- A. Adjust Units to provide correct clearances.
- B. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.5 WASTE MANAGEMENT**

- A. Collect Packaging Waste, and place where directed for recycling.

**3.6 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 WORK INCLUDED**

- A. In accordance with governing laws, regulations, codes, Design Loads listed in Structural Notes on Drawings, and requirements specified in Section 01-11-50; design, engineer, fabricate, and erect Metal Building as specified herein and as shown on Drawings.

**1.3 PRODUCTS FURNISHED, BUT INSTALLED UNDER OTHER SECTIONS**

- A. Anchor Bolts: Section 03-10-00

**1.4 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Concrete: Division 3
- B. Structural Steel: Section 05-10-00
- C. Wall & Roof Panels: Section 07-41-00
- D. Sheetmetal Flashing & Trim: Section 07-62-00
- E. Caulking & Sealing: Section 07-92-00
- F. Hollow Steel Work: Section 08-11-00
- G. Sectional Overhead Doors: Section 08-36-00
- H. Aluminum Entrance System: Section 08-40-00
- I. Interior Finishes: Division 9
- J. Mechanical & Electrical Work: See Mechanical & Electrical Specifications

**1.5 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.6 REFERENCED SPECIFICATIONS**

- A. Comply with applicable portions of Specification for Design, Fabrication, & Erection of Structural Steel Buildings, published by American Institute of Steel Construction (AISC); One East Wacker; S-3100; Chicago, IL 60611-4185; (312) 670-2400.

**PART 1 - GENERAL**

**1.7 SYSTEM DESCRIPTION**

- A. Primary Framing: Clear-span Rigid Frame System
- B. Secondary Framing: Purlins, Girts, and Bracing necessary for complete and structurally sound installation.
- C. Exterior Wall & Roof Panels: Factory-formed and Factory-finished Metal Panels with necessary Subgirt Framing, Anchors, Flashings, and Trim.
- D. Explosion-resistant Connections: Provide at Roof to Exterior Wall connections.

**1.8 DESIGN REQUIREMENTS**

- A. Comply with the following:
  - 1. Minimum Positive Live Loads: See Structural Notes on Drawings
  - 2. Minimum Seismic, Snow, & Wind Loads: Comply with Building Code
  - 3. Maximum Wall & Roof Deflection: 1/180 of fully loaded Span
  - 4. Minimum Thermal Expansion: Resistant to stress from 100°F temperature shift without buckling, Joint Seal failure, or excessive Fastener stress.

**1.9 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.10 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Indicate the following:
  - 1. Dimensioned Building Plan, Cross Sections, and Wall Elevations.
  - 2. Materials, Finishes, Construction details, Bracing, Connections, Anchorage, and any other pertinent information.

**1.11 CERTIFICATE OF COMPLIANCE**

- A. Submit written affidavit, bearing seal and signature of Structural Engineer licensed to practice in Oregon, that Work of this Section complies with Drawings, Specifications, and governing Codes and Regulations.

(Cont.)



**PART 1 - GENERAL**

**1.12 PERSONNEL QUALIFICATIONS**

- A. System Design Engineer: Structural Engineer licensed to practice in Oregon
- B. Fabricator: 5 years minimum experience performing Work of type specified herein.
- C. Erector: 5 years minimum experience performing Work of type specified herein, and approved by System Fabricator

**1.13 PRE-ERECTION CONFERENCE**

- A. Prior to Building erection, and in accordance with Section 01-31-50, arrange Meeting to clarify any questions about Specifications or erection requirements.
- B. Representatives of the following shall attend:
  - 1. General Contractor
  - 2. Factory-engineered Building Fabricator
  - 3. Factory-engineered Building Erector
  - 4. Wall & Roof Panel Subcontractor
  - 5. Mechanical & Electrical Subcontractors
  - 6. Any other involved Subcontractors

**1.14 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage, distortion, and discoloration.
- B. Handle Components with non-marring Slings. Do not bend.
- C. Store Panels above ground and with one end elevated for drainage. If Panels become wet, immediately separate, wipe dry with clean cloth, and continue to separate until dry.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURER**

- A. American, Butler, Metallic, Pascoe, Varco-Pruden, or approved,

**2.2 STRUCTURAL FRAME**

- A. Comply with Referenced Specifications

**PART 2 - PRODUCTS**

**2.3 WALL & ROOF PANELS**

- A. See Section 07-41-00

**2.4 SHEETMETAL GUTTERS, DOWNSPOUTS, & FLASHING:**

- A. See Section 07-62-00

**2.5 THERMAL INSULATION**

- A. See Section 07-20-00

**2.6 HOLLOW STEEL DOOR FRAMES**

- A. See Section 08-11-00

**2.7 SECTIONAL OVERHEAD DOORS**

- A. See Section 08-36-00 & 08-36-50

**2.8 ALUMINUM ENTRANCE DOORS & WINDOWS**

- A. See Section 08-40-00

**2.9 FABRICATION**

- A. Comply with Referenced Specifications.

(Cont.)

**PART 3 - EXECUTION**

**3.1 EXISTING CONDITIONS**

- A. Do not proceed until Structure and Surfaces to receive Building Components are accurately sized and located, true, smooth, clean, and otherwise properly prepared in accordance with approved Shop Drawings.
- B. Prior to starting Work, notify General Contractor about defects requiring correction.
- C. Do not start Work until conditions are satisfactory.

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 SURFACE PREPARATION**

- A. Protect contacting Dissimilar Materials against Galvanic Corrosion with Asphaltic Compound, 7-1/2 mil minimum dry thickness, applied to each contacting face.

**3.4 ERECTION GENERAL**

- A. Accurately position and secure Components level, plump, true to line, without distortion, and in accordance with Referenced Specifications, Manufacturer's Instructions, and approved Shop Drawings.
- B. Make installation weatherproof and watertight.

**3.5 FRAME ERECTION**

- A. See Section 05-10-00
- B. Provide Framing to support Cranes, Mechanical, or other Equipment; secure to Structural Frame.
- C. Provide Framing around Openings in Wall and Roof Panels; secure to Structural Frame.
- D. Allowable Erection Tolerance: Comply with Referenced Specifications.

**3.6 WALL & ROOF PANEL INSTALLATION**

- A. See Section 07-41-00

**3.7 SHEETMETAL GUTTER, DOWNSPOUT, & FLASHING INSTALLATION**

- A. See Section 07-62-00

**PART 3 - EXECUTION**

**3.8 THERMAL INSULATION INSTALLATION**

- A. See Section 07-20-00

**3.9 HOLLOW STEEL DOOR FRAME INSTALLATION**

- A. See Section 08-11-00

**3.10 SECTIONAL OVERHEAD DOORS**

- A. See Section 08-36-00 & 08-36-50

**3.11 ALUMINUM ENTRANCE DOOR & WINDOW INSTALLATION**

- A. See Section 08-40-00

**3.12 TOUCH UP**

- A. Wire brush, clean, and paint Welds, Scarred Areas, and Rust Spots.
- B. Touch-up damaged Paint Surfaces with same Paint used in Shop. Apply in accordance with Paint Manufacturer's directions.

**3.13 WASTE MANAGEMENT**

- A. Collect Shipping Pallets, Metal Strapping, & Packaging Waste; and place where directed for recycling.

**3.14 PRODUCT CLEANING & REPAIRING**

- A. At completion of each day's work and at Work completion, sweep Panels, Gutters, and Flashings clean. Do not allow Fasteners, Cuttings, Fillings, or Scraps to accumulate on Finish Surfaces.
- B. 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.
- C. Remove Debris from Project Site upon Work completion, or sooner if directed.

**END OF SECTION**

**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 PRODUCTS FURNISHED, BUT INSTALLED UNDER OTHER SECTIONS**

- A. Anchor Bolts and necessary Setting Templates.

**1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS**

- A. Electrical Conduit & Wiring and connections to Items specified herein: See Electrical Specifications

**1.4 ALTERNATES**

- A. Refer to Section 01-20-00 for possible effect upon Work of this Section.

**1.5 COORDINATION**

- A. Coordinate with other Trades affecting or affected by Work of this Section.

**1.6 SHOP DRAWINGS**

- A. Submit in accordance with Section 01-33-00.
- B. Show dimensions, required clearances, methods of joining to other Work, utility locations, and other pertinent information.

**1.7 OPERATING & MAINTENANCE DATA**

- A. In accordance with Section 01-83-00, submit to General Contractor for inclusion in Owner's Maintenance Manual.

**1.8 INSTALLER'S QUALIFICATIONS**

- A. Employed by or acceptable to Equipment Manufacturer.

**CRANES****PART 1 - GENERAL****1.9 REGULATORY AGENCY REQUIREMENTS**

- A. Building Code requirements govern, if more rigid than those specified herein. Notify Architect of differences prior to fabrication.
- B. Conform to requirements of Agencies:
  - 1. Underwriters Laboratories
  - 2. Occupational Safety & Health Act

**1.10 PRODUCT DELIVERY, STORAGE, & HANDLING**

- A. Protect against damage and discoloration.

**1.11 FIELD MEASUREMENTS**

- A. Verify prior to ordering Equipment.
- B. If field measurements differ slightly from Drawing dimensions, modify adjacent Construction as required for accurate fit. If measurements differ substantially, notify Architect prior to ordering Equipment.

**PART 2 - PRODUCTS****2.1 SHOP CRANE**

- A. Manufacturer: \_\_\_\_\_, or approved.
- B. Model: \_\_\_\_\_
- C. Type: \_\_\_\_\_
- D. Minimum Lifting Capacity: \_\_\_\_ lbs.
- E. Material: Steel
- F. Factory Finish:
  - 1. Material: Manufacturer's standard baked-on Enamel
  - 2. Color: Selected by Architect after Contract award from Manufacturer's standard choices.

(Cont.)

**CRANES****PART 2 - PRODUCTS****2.2 MEASURING ROOM CRANE**

- A. Manufacturer: \_\_\_\_\_, or approved.
- B. Model: \_\_\_\_\_
- C. Type: \_\_\_\_\_
- D. Minimum Lifting Capacity: \_\_\_\_ lbs.
- E. Material: Steel
- F. Factory Finish:
  - 1. Material: Manufacturer's standard baked-on Enamel
  - 2. Color: Selected by Architect after Contract award from Manufacturer's standard choices.

**2.3 REQUIRED ACCESSORIES**

- A. Provide Equipment complete with all necessary Accessories including, but not limited to the following:
  - 1. Anchor Bolts
  - 2. Motor Starters (Verify required Power Characteristics)
  - 3. Start/Stop Controls
  - 4. Overload Protection Devices
  - 5. Utility Connection Devices

**2.4 BLOCKING & BACKING**

- A. Provide where necessary.
- B. Equipment shown on Drawings is located for Contractor's convenience. Before installing Blocking and Backing, verify Equipment type, location, and extent of Work.

**PART 3 - EXECUTION****3.1 EXISTING CONDITIONS**

- A. Verify that Structure and Surfaces to receive Equipment are properly prepared.
- B. Verify that Electrical Utilities are accurately installed.
- C. Prior to starting Work, notify General Contractor about defects requiring correction.
- D. Do not start Work until conditions are satisfactory.

**PART 3 - EXECUTION**

**3.2 PROTECTING WORK OF OTHER SECTIONS**

- A. Protect against damage and discoloration caused by Work of this Section.

**3.3 INSTALLATION**

- A. Follow Manufacturer's instructions.
- B. Position plumb, level, square, straight, and true as applicable.
- C. Securely anchor to adjacent Construction.
- D. Make all Utility connections.

**3.4 ADJUSTMENTS**

- A. Adjust Moving Parts to operate satisfactorily at time of Project Substantial Completion and during Warranty Period.

**3.5 PRODUCT CLEANING & REPAIRING**

- 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. Remove Debris from Project Site upon work completion or sooner, if directed.

**3.6 WASTE MANAGEMENT**

- A. Collect Metal Strapping & Packaging Waste, and place where directed for recycling.

**3.7 OPERATING & MAINTENANCE DEMONSTRATIONS**

- A. In accordance with Section 01-83-00, personally instruct Owner's Representative in proper operation and maintenance methods.

**3.8 READJUSTING**

- A. 30 Days prior to Warranty expiration, inspect and where necessary, readjust Equipment to operate smoothly, easily, and properly.

**END OF SECTION**





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Phone: 503-892-1188

# OMIC ADDITIVE MANUFACTURING CENTER

## Scappoose, OR

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#### *Division 22 – Plumbing*

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22 10 05	Plumbing Piping
22 10 06	Plumbing Piping Specialties
22 15 00	General-Service Compressed-Air System
22 30 00	Plumbing Equipment
22 40 00	Plumbing Fixtures

#### *Division 23 – Heating, Ventilating, and Air Conditioning (HVAC)*

<b>Section:</b>	<b>Title:</b>
23 00 00	Basic HVAC Requirements
23 05 48	Vibration Isolation and Sound and Seismic Controls for HVAC Piping and Equipment

*Continued next page...*



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## ***Division 23 – Heating, Ventilating, and Air Conditioning (HVAC)***

<b>Section:</b>	<b>Title:</b>
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23 05 49	HVAC Seismic Restraint
23 05 53	Identification for HVAC Piping and Equipment
23 05 56	HVAC Enclosed Motor Controllers
23 05 57	HVAC Variable Frequency Controllers
23 05 93	Testing, Adjusting, and Balancing for HVAC
23 07 13	Duct Insulation
23 09 13	Instrumentation and Control Devices for HVAC (Not Included in this submission)
23 09 23	Direct Digital Control (Not Included in this submission)
23 09 93	Sequence of Operations for HVAC Controls (Not Included in this submission)
23 10 05	Fuel Piping
23 31 00	HVAC Ducts and Casings
23 33 00	Air Duct Accessories
23 34 23	HVAC Power Ventilators
23 36 00	Air Terminal Units
23 37 00	Air Outlets and Inlets
23 74 12	Packaged Outdoor Rooftop Units – Small Capacity
23 74 13	Packaged Outdoor Central-Station Rooftop Units
23 74 15	Custom Air Handling Units
23 81 26	Small Capacity Split-System Air Conditioners
23 84 13	Humidifiers

**BASIC FIRE SUPPRESSION REQUIREMENTS****PART 1 GENERAL****1.1. DESCRIPTION OF WORK**

- A. This Section specifies the basic requirements for all Contractor installed equipment. It applies to all sections included in Division 21. The requirements herein are an expansion upon the requirements of Division 1.
- B. Provide all materials, labor and equipment required to install complete and fully operational fire protection systems as indicated by the contract drawings, this specification, and requirements of authority (ies) having jurisdiction (AHJ).
- C. Contractor shall provide complete engineering calculations and design of the fire protection system satisfying the direction and criteria of this specification and all other supporting documents and drawings.
- D. Provide the design and all materials, labor and equipment required to install a complete and fully operational fire protection system as indicated by the contract drawings and this specification.
- E. Contractor shall not compromise or diminish any existing building system, service or function in his execution of the work. Any such potential impacts shall be immediately brought to the attention of the Architect.
- F. Obtain and pay for all permits, licenses, fees and taxes applicable to this project as required by law.
- G. Cooperate with other trades in furnishing material and information required for installation and operation of mechanical items.
- H. Requirements for the following are included:
  - 1. Related work (other Contract Documents and specification sections) that must be combined with the requirements of this Section.
    - a. Design performance.
    - b. Delivery, storage, and handling.
    - c. Quality assurance and standards.
    - d. Submittals.
    - e. Product quality, basic type, and finishes.
    - f. Equipment identification.
    - g. Excavation and backfill.
    - h. Installation.
    - i. Mounting and shimming.
    - j. Inspection.
    - k. Safety considerations.
    - l. Cleaning, startup, and adjustments.

**1.2. RELATED WORK**

- A. This general section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total requirements for the project equipment and systems:
  - 1. Division 1 sections included in this Project specifications.

**BASIC FIRE SUPPRESSION REQUIREMENTS**

2. The Contract.
3. General and specific specifications and drawings included in the project.

**1.3. DEFINITIONS**

- A. Indicated”: Refers to graphic representations, notes or schedules in the Drawings; or to other paragraphs or schedules in Specifications and similar requirements in the Contract Documents.
1. Terms such as “shown”, “noted”, “scheduled”, and “specified”, are used to notify or help the user to locate reference. Location is not limited.
- B. “Directed”: Terms such as “directed”, Requested”, “authorized”, “selected”, “approved”, “required”, and “permitted” mean directed by Architect/Engineer, approved by Architect/Engineer and similar phrases.
- C. “Approved”: When used in conjunction with Architect/Engineer's action on contract submittals, applications, requests, is limited to Architect/Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- D. “Regulations”: Includes laws, ordinances, statutes and lawful orders issued by authorities having jurisdiction, as well as rules, conventions and agreements within the construction industry that control performance of Work.
- E. “Furnish”: Means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation and similar operations.
- F. “Install”: Describes operations at Project site including actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, supporting, isolating, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations.
- G. “Provide”: Means to furnish and install.
- H. “Installer”: A contractor, or another entity engaged by the contractor, either as an employee, subcontractor, or contractor of a lower tier, to perform a particular construction activity including installation, erection, application or similar operations.
1. Installers are required to be experienced in operations they are engaged to perform.
  2. The term “experience” means having successfully completed a minimum of three previous projects similar in scope and size to this Project and within the time frame indicated in the “Quality Assurance” section of the Specifications. In addition, in means being familiar with special requirements indicated and having complied with requirements of authorities having jurisdiction.
- I. “Project Site”: Is defined as the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of Project.

**1.4. DESIGN PERFORMANCE**

- A. Compliance by the Contractor and/or Vendor with the provisions of this Specification does not relieve him of the responsibilities of furnishing equipment and materials of proper design, suited to meet operating guarantees at the specified service conditions.

**BASIC FIRE SUPPRESSION REQUIREMENTS****1.5. SUBMITTALS**

- A. Product Data: Submit complete sets of manufacturer's product data in .PDF format for approval. All Submittals to be received in no more than (3) three packages. See Division 1 for further information regarding submittal requirements. Literature submitted shall clearly indicate the model number, capacity, rated operating conditions, size, weight, support requirements, electrical power requirements, utility (fuel, air, cooling water, etc.) requirements, and options furnished. Submittals shall include, but are not necessarily limited to the following;
1. Fire Protection: Piping materials, valves, fittings, supports, switches, alarms, sprinkler heads, compressors, and fire pumps and the like. Provide minimum 36 x 24 size system layout shop drawings. Provide hydraulic calculations.
  2. Calculations: Provide for sizing of all utility services, including fire sprinkler main and all building piping; pumps head and flow sizing for all systems; thermal expansion and seismic restraints; and all other calculations and all other calculations consistent with good engineering practice. Include design criteria used and assumptions made.
- B. Operation and Maintenance Data: Submit three complete sets of manufacturer's literature bound in a three ring binder for approval. Data shall include installation, start-up, and maintenance instructions, parts lists, and wiring diagrams. Include all material on a CD-ROM or USB device.
- C. Substitutions: System design was based upon the equipment and materials listed on the drawings and specifications herein. At contractor's option, another manufacturer's equipment of similar quality, capacity and features may be submitted for prior approval per Section 01 30 00. Prior permission to substitute does not relieve the contractor of the responsibility of including this information in the bound submittal packages.

**1.6. QUALITY ASSURANCE**

- A. Codes and Standards: Comply with the provisions of the following codes, standards and specifications, except where more stringent requirements are shown or specified:
1. State of Oregon "IBC".
  2. State of Oregon "IMC".
  3. State of Oregon "UPC".
  4. State of Oregon "IFC".
  5. NPC Codes and Standards including, but not limited to, NFPA 13 and NFPA 25.
- B. Drawings: All drawings are diagrammatic and show general design, arrangement, and extent of the systems. Do not scale drawings for rough-in dimensions, nor use as shop drawings.
- C. Installer Qualifications: Company specializing in performing the work required with a minimum of five years documented experience.

**1.7. DELIVERY, STORAGE AND PROTECTION**

- A. Delivery: Deliver to site with manufacturer's labels intact and legible.

**BASIC FIRE SUPPRESSION REQUIREMENTS**

- B. Preparation for shipment:
  - 1. Each unit shall be suitably prepared for the shipment specified and for storage in accordance with manufacturer's instructions in a manner requiring no disassembly prior to operation.
  - 2. The Contractor shall be solely responsible for the adequacy of the Preparation for Shipment provisions employed with respect to materials and application.
  - 3. One complete set of Installations, Operating and Maintenance Instructions shall be packed and shipped with the equipment. This set is in addition to the sets that are to be sent directly to the Owner.
- C. Handling: Avoid damage. Comply with manufacturer's installation instruction requirements for rigging, unloading and transporting units.
- D. Storage: Inside protected from weather, dirt and construction dust. Where necessary to store outside, elevate well above grade and enclose with durable, waterproof wrapping. Cap all pipe ends. Taping pipe ends is not adequate or allowable.

**1.8. PROJECT CONDITIONS**

- A. General: Provide products which are compatible with other portions of the work and provide products with the proper power characteristics and similar adaptations for the project.
- B. Arrangement: Arrange piping parallel with primary lines of the building construction and with a minimum 7 feet overhead clearance in unfinished equipment rooms where possible. Conceal all piping where possible unless indicated otherwise. Locate operating and control equipment properly to provide easy access for operation and maintenance. Give right-of-way to piping which must be sloped for drainage. Set all equipment level or as recommended by manufacturer.
- C. Coordination: Where several elements of the work must be sequenced and positioned in order to fit the available space, prepare shop drawings showing the actual physical dimensions (at accurate scale) required for installation and submit prior to purchase/fabrication/installation of any of the elements involved in the coordination.

**1.9. STANDARDS**

- A. General: Provide all new materials and equipment, identical to apparatus or equipment in successful operation for a minimum of five years. Provide materials of comparable quality omitted here but necessary to complete the work. Maximum allowable variation from stated capacities, minus 5% to plus 10% as approved in each case.
- B. Governing Standards: The following are typical standards generally referenced in these specifications and identified by their acronym. Factory Mutual (FM), Federal Specifications (FS), American Society for Testing Materials (ASTM), American National Standards Institute (ANSI), Manufacturer's Standardization Society of the Valve and Fitting Industry, Standard Practice (MSS SP-69), Underwriters Laboratory (UL) numbers are given.

**BASIC FIRE SUPPRESSION REQUIREMENTS****1.10. WARRANTIES**

- A. Contractor shall provide a 1 year warranty on all equipment, materials and workmanship for a period of one year from the date of owner's acceptance.

**PART 2 PRODUCTS (NOT USED)****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. Verify all indicated elevations, building measurements, rough-in dimensions and equipment locations before proceeding with any work.
- B. Utility Locations: The location of all utilities, wires, conduits, pipes, ducts, or other service facilities are shown in a general way only on the drawings. 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.
- C. Discrepancies: Any error, conflict or discrepancy in Drawings, Specifications and/or existing conditions shall be reported immediately. Do not proceed with any questionable items of work until clarification of same has been made. Should rearrangement or re-routing of piping or ductwork be necessary, provide for approval the simplest layout possible for that particular portion of the work. Under no circumstances shall beams, girders, footings or columns be cut for mechanical items. Casting of pipes into concrete is prohibited unless so shown on Drawings.
- D. The Contractor shall cooperate with others to avoid interferences and delays in the construction work.
- E. Interference as a result of poor coordination or lack of cooperation with other trades shall be corrected at the Contractor's expense.

**3.2. CUTTING AND PATCHING**

- A. General: Perform cutting and patching in accordance with Division 1.
- B. Protection: During cutting and patching, protect adjacent installations. Provide temporary barriers to prevent the spread of dust and dirt outside of the immediate work area.
- C. Repair: Patch finished surfaces and building components using new materials to match the existing.
- D. Inspection: Upon written direction from the Architect, uncover and restore work to provide for observation of concealed work.

**BASIC FIRE SUPPRESSION REQUIREMENTS****3.3. EXCAVATION AND BACKFILL**

- A. General: Perform all necessary excavation and backfill required for the installation of mechanical work. Any piping or other work damaged by the Contractor's operations shall be repaired at the Contractor's expense.
- B. Water: Keep all excavations free of standing water. Excavations damaged or softened by water or frost shall be re-excavated and filled back to original level with approved material at the Contractor's expense.
- C. Test: During the progress of the work for compacted fill, the Owner reserves the right to request compaction tests made under the direction of a testing laboratory.
- D. Trench Excavation: Excavate trenches to the necessary depth and width, removing rocks, unstable soil (silt, peat, etc.) roots and stumps. Width of trench shall be adequate for proper installation of piping or conduit.
- E. Foundation and Bedding:
  - 1. Proper preparation of foundation, placement of foundation material where required, and placement of bedding material shall precede the installation of the pipe. This shall include leveling of the trench bottom as well as placement and compaction of required bedding material to a uniform grade so that piping rests upon a continuous and uniform bedding.
  - 2. Where excavation has been made below the required grade, the Contractor shall provide, place and compact suitable bedding material to restore the proper grade elevation.
- F. Provide tracer wire over top of piping.
  - 1. Construction:
    - a. Conductor: Solid or stranded copper per spec ASTM B-3.
    - b. Insulation: High Molecular Weight Polyethylene (HMWPE) ASTM D-1248. Various insulation colors dependant on usage.
    - c. Temperature: 70 degrees C dry and wet.
    - d. Voltage: 20 and 30 Mil = 30 to 300 volts. 45 Mil = 600 volts.
- G. Backfilling: Upon acceptance of installed piping systems, trenches shall be backfilled in lifts. Backfill material shall be placed and compacted in lifts not to exceed 6 inches in depth to a height of 1 inch above the top of trench. Backfill shall be placed to obtain contact with the entire periphery of the pipe without disturbing pipe placement.
- H. Compaction: One of the following methods or combination thereof shall be required; 1) Mechanical Tamper or Vibratory Compactor. Compaction shall be sufficient to attain 95% of maximum density at optimum moisture content. Water "puddling" or "washing" is prohibited.
- I. Bedding/Backfill Material: Where native material has been removed, necessary foundation material consisting of 3/4 inch minus crushed rock or fill sand shall be placed and compacted to form a firm base of the required thickness. Backfill material shall be the same. Follow the pipe manufacturer's installation instructions when specified materials are specifically prohibited.



**BASIC FIRE SUPPRESSION REQUIREMENTS****3.4. MECHANICAL EQUIPMENT WIRING**

- A. Provide all motor starters, control devices, and wiring complete from power source indicated on Drawings.
- B. Equipment and systems shown on the Drawings and/or specifications, 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 controls for the actual selected equipment/system.

**3.5. INSTALLATION**

- A. Locating and Positioning Equipment: Observe all Codes and Regulations and good common practice in locating and installing equipment and material so that completed installation presents the least possible hazard. Maintain recommended clearances for repair and service to all equipment.
- B. 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.
- C. Where mounting heights or locations are not identified, install systems, equipment and materials to provide maximum headroom.
- D. Provide clearance for installation of insulation and access to valves, fittings, etc., on pipe systems.
- E. Install systems, materials and equipment giving right of way to systems required to be installed at a specific slope or operation by gravity.
- F. Installation shall be in accordance with the requirements of the equipment manufacturer, including special requirements for seismic restraints.

**3.6. MOUNTING AND SHIMMING**

- A. Mount and install equipment per manufacturer's recommendations.
- B. Level the equipment by means of 304 stainless steel wedges (stainless steel plates and stainless steel shims). Wedge taper shall not be greater than 1/4 inch per foot. Use double wedges to provide a level bearing surface for the equipment. Secure each pair of wedges in their final positions with one tack weld on each side after leveling is complete. Wedging shall be executed in a manner that will prevent a change in level or springing of the Baseplate when the anchor bolts are tightened.

**3.7. INSPECTION**

- A. The Contractor shall inspect his work to ensure the installation and workmanship is in accordance with these specifications and acceptable industry standards.
- B. All materials, equipment, and workmanship shall be subject to inspection at any time by the Owner. Contractor shall correct any work, materials, or equipment not in accordance with the Contract Documents.

**BASIC FIRE SUPPRESSION REQUIREMENTS****3.8. SAFETY CONSIDERATIONS**

- A. All equipment shall be installed with suitable access clearances that satisfy OSHA and code requirements for maintenance or removal of replaceable parts and components, and with necessary unions or flanges to perform the maintenance or removal without removing the connecting appurtenances.

**3.9. CLEANING, START-UP, AND ADJUSTING**

- A. The Contractors shall be responsible for proper operation of all systems, minor subsystems, and services provided under this section. He shall coordinate start-up procedures, calibration, and system checkout with all project managers. Any system operational problems shall be diagnosed; all correctional procedures shall be initiated as required to bring out the system into compliance with the design, and the problem then shall be rechecked to verify that the system operates normally.
- B. Thoroughly clean all parts of the installation at the completion of the work. The Contractor shall clean up and remove from the premises all refuse material, crates, and rubbish arising from his work.

**END OF SECTION**

**FIRE PROTECTION BASIC MATERIALS AND METHODS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Pipe, fittings, valves, and connections for sprinkler, standpipe and fire hose, and combination sprinkler and standpipe systems.

**1.2. RELATED REQUIREMENTS**

- A. Section 21 13 00 - Fire Suppression Sprinklers: Sprinkler systems design.

**1.3. REFERENCE STANDARDS**

- A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; The American Society of Mechanical Engineers; 2010.
- B. ASME B16.5 - Pipe Flanges and Flanged Fittings; The American Society of Mechanical Engineers; 2009.
- C. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 2009.
- D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- E. ASTM A135/A135M - Standard Specification for Electric-Resistance Welded Steel Pipe; 2009.
- F. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2008.
- G. AWWA C110/A21.10 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm Through 1200 mm), for Water and Other Liquids; American Water Works Association; 2008.
- H. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; 2007 (ANSI/AWWA C111/A21.11).
- I. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; 2009 (ANSI/AWWA C151/A21.51).
- J. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2010.
- K. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.
- L. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.
- M. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.

**FIRE PROTECTION BASIC MATERIALS AND METHODS**

- C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections. Shop drawings shall be minimum 36 x 24 size.
- D. Project Record Documents: Record actual locations of components and tag numbering.
- E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

**1.5. QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.
- C. Conform to UL, FM, and Warnock Hersey requirements.
- D. Valves: Bear UL, FM, and Warnock Hersey label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- E. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

**1.6. DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store valves in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

**PART 2 PRODUCTS****2.1. FIRE PROTECTION SYSTEMS**

- A. Sprinkler Systems: Conform work to NFPA 13.
- B. Welding Materials and Procedures: Conform to ASME Code.

**2.2. BURIED PIPING**

- A. Cast Iron Pipe: AWWA C151/A21.51.
  - 1. Fittings: AWWA C110, standard thickness.
  - 2. Joints: AWWA C111, rubber gasket.
  - 3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

**2.3. ABOVE GROUND PIPING**

- A. Steel Pipe: ASTM A795 Schedule 10, ASTM A53 Schedule 40, ASTM A135/A135M Schedule 10, ASTM A135/A135M UL listed light wall type, or ASTM A795 Schedule 40, black or galvanized.
  - 1. Steel Fittings: ASME B16.9, wrought steel, butt welded, ASME B16.5, butt weld ends, ASTM A 234/A 234M, wrought carbon steel or alloy steel, ASME B16.5,

**FIRE PROTECTION BASIC MATERIALS AND METHODS**

steel flanges and fittings, or ASME B16.11, forged steel socket welded and threaded.

2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A 47/A 47M.
4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
5. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocket and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

**2.4. FLEXIBLE SPRINKLER HOSE FITTINGS**

- A. FlexHead Industries flexible sprinkler connections.

**2.5. PIPE HANGERS AND SUPPORTS**

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or carbon steel, adjustable swivel, split ring.
- B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.
- C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- D. Vertical Support: Steel riser clamp or angle ring.
- E. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

**2.6. GATE VALVES**

- A. Up to and including 2 inches:
  1. Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.
- B. Over 2 inches:
  1. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid rubber covered bronze or cast iron wedge, flanged ends.
- C. Over 4 inches:
  1. Iron body, bronze trim, non-rising stem with bolted bonnet, solid bronze wedge, flanged ends, iron body indicator post assembly.

**2.7. ANGLE VALVES**

- A. Up to and including 2 inches:
  1. Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable rubber disc, threaded ends, with backseating capacity repackable under pressure.
- B. Over 2 inches:
  1. Iron body, bronze trim, rising stem, handwheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

**FIRE PROTECTION BASIC MATERIALS AND METHODS****2.8. BALL VALVES**

- A. Up to and including 2 inches:
  - 1. Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle and balancing stops, threaded ends with union.

**2.9. CHECK VALVES**

- A. Up to and including 2 inches:
  - 1. Bronze body and swing disc, rubber seat, threaded ends.
- B. Over 2 inches:
  - 1. Iron body, bronze trim, swing check with rubber disc, renewable disc and seat, flanged ends with automatic ball check.
- C. 4 inches and Over:
  - 1. Iron body, bronze disc, stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

**2.10. DRAIN VALVES**

- A. Ball Valve:
  - 1. Brass with cap and chain, 3/4 inch hose thread.

**PART 3 EXECUTION****3.1. PREPARATION**

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

**3.2. INSTALLATION**

- A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Sleeve pipes passing through partitions, walls, and floors.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Pipe Hangers and Supports:
  - 1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

**FIRE PROTECTION BASIC MATERIALS AND METHODS**

2. Place hangers within 12 inches of each horizontal elbow.
  3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  6. Prime coat exposed steel hangers and supports. Refer to Section 09 90 00. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- H. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- I. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. Refer to Section 09 90 00.
- J. Do not penetrate building structural members unless indicated.
- K. Provide sleeves when penetrating footings, floors, and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- L. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- M. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.
- N. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.
- O. Provide gate or ball valves for shut-off or isolating service.
- P. Provide drain valves at main shut-off valves, low points of piping and apparatus.
- Q. The fire sprinkler contractor shall coordinate and provide for the location of all fire sprinkler drain piping and drain receptor piping, whether or not indicated on the contract documents. The routing of low point drains to any location where there is no drain receptor is NOT acceptable.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Wet-pipe sprinkler system.
- B. Dry-pipe sprinkler system.
- C. System design, installation, and certification.
- D. Fire department connections.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping.
- B. Section 21 05 00- Fire Protection Basic Materials and Methods: Pipe, fittings, and valves.
- C. Division 26: Electrical characteristics and wiring connections.

**1.3. REFERENCE STANDARDS**

- A. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2010.
- B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

**1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week before starting work of this section.

**1.5. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Shop Drawings:
  - 1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
  - 2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
  - 3. Submit shop drawings, product data, and hydraulic calculations to authority having jurisdiction and Fire Marshall for approval. Submit proof of approval to Architect/Engineer.
  - 4. Shop drawings shall be minimum 36 x 24 size.
- D. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.
- E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds code requirements.



- F. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
  - 3. Sprinkler Wrenches: For each sprinkler type.

**1.6. QUALITY ASSURANCE**

- A. Maintain one copy of referenced design and installation standard on site.
- B. Conform to UL requirements.
- C. Designer Qualifications: Design system under direct supervision of a recognized fire sprinkler contractor experienced in design of this type of work and licensed in Oregon.
- D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience approved by manufacturer.
- F. Equipment and Components: Provide products that bear UL label or marking.
- G. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

**1.7. DELIVERY, STORAGE, AND HANDLING**

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

**PART 2 PRODUCTS**

**2.1. SPRINKLER SYSTEM**

- A. Sprinkler System: Provide coverage for entire building.
- B. Occupancy: Comply with NFPA 13.
- C. Water Supply: Determine volume and pressure from water flow test data.
  - 1. If test data is not available assume 2000 gpm at 20 psig.
  - 2. Revise design when test data available prior to submittals.
- D. Interface system with building fire and smoke alarm system.
- E. Provide fire department connections where indicated, or as required by Authority Having Jurisdiction.
- F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

**2.2. SPRINKLERS**

- A. Suspended Ceiling Type: Recessed pendant type with matching push on escutcheon plate.

**FIRE SUPPRESSION SPRINKLERS**

1. Manufacturers:
    - a. Tyco.
    - b. Reliable: [www.reliablesprinkler.com](http://www.reliablesprinkler.com).
    - c. Viking.
  2. Response Type: Quick or Standard.
  3. Coverage Type: Standard or Extended.
  4. Finish: Chrome plated.
  5. Escutcheon Plate Finish: Chrome plated.
  6. Fusible Link: Fusible solder link type or Glass bulb type, temperature rated for specific area hazard.
- B. Exposed Area Type: Standard type .
1. Manufacturers:
    - a. Tyco.
    - b. Viking.
    - c. Reliable: [www.reliablesprinkler.com](http://www.reliablesprinkler.com).
  2. Response Type: Quick or Standard.
  3. Coverage Type: Standard or Extended.
  4. Finish: Brass.
  5. Fusible Link: Fusible solder link type or Glass bulb type, temperature rated for specific area hazard.
- C. Sidewall Type: Recessed horizontal sidewall type with matching push on escutcheon plate.
1. Manufacturers:
    - a. Tyco.
    - b. Viking.
    - c. Reliable: [www.reliablesprinkler.com](http://www.reliablesprinkler.com).
  2. Response Type: Quick or Standard.
  3. Coverage Type: Standard or Extended.
  4. Finish: Chrome plated.
  5. Escutcheon Plate Finish: Chrome plated.
  6. Fusible Link: Fusible solder link type or Glass bulb type, temperature rated for specific area hazard.
- D. Dry Sprinklers: Recessed pendant type with matching push on escutcheon plate.
1. Manufacturers:
    - a. Viking.
    - b. Tyco.
    - c. Reliable: [www.reliablesprinkler.com](http://www.reliablesprinkler.com).
  2. Response Type: Quick or Standard.
  3. Coverage Type: Standard or Extended.
  4. Finish: Brass.
  5. Escutcheon Plate Finish: Brass.
  6. Fusible Link: Fusible solder link type or Glass bulb type, temperature rated for specific area hazard.

**2.3. PIPING SPECIALTIES**

- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with pressure retard chamber and variable pressure trim; with test and drain valve.
- B. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm and electric alarm, with accelerator; with test and drain valve.
- C. Electric Alarm: Electrically operated red enameled gong with pressure alarm switch.
- D. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC. Grinnell Model VSR-1.
- E. Fire Department Connections:
  - 1. Type: Flush mounted wall type with brass finish.
  - 2. Outlets: Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
  - 3. Drain: 3/4 inch automatic drip, outside or connected to drain.
  - 4. Label: "Sprinkler - Fire Department Connection".
- F. Air Compressor: UL listed single unit capable of being hard wired where required by AHJ, electric motor driven, motor, motor starter, safety valves, check valves, air maintenance device incorporating electric pressure switch and unloader valve. Compressor shall have capacity to charge to system pressure within 15 minutes. Refer to Division 26 for electrical characteristics.
- G. Supervisory Switches: As manufactured by Grinnell OSYSU-1 or OSYSU-2, Potter-Roemer Figure 6220, or approved equal.

**PART 3 EXECUTION**

**3.1. INSTALLATION**

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Install buried shut-off valves in valve box. Provide post indicator.
- D. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.
- E. Locate outside alarm gong on building wall.
- F. Place pipe runs to minimize obstruction to other work.
- G. Place piping in concealed spaces above finished ceilings.
- H. Center sprinklers in one direction only in ceiling tile with location in other direction variable, dependent upon spacing and coordination with ceiling elements.
- I. Provide oversize escutcheons on all sprinklers to allow for seismic movement.
- J. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- K. Flush entire piping system of foreign matter.

**FIRE SUPPRESSION SPRINKLERS**

- L. Hydrostatically test entire system.
- M. Require test be witnessed by Fire Marshal and Architect/Engineer.

**3.2. INTERFACE WITH OTHER PRODUCTS**

- A. Ensure required devices are installed and connected as required to fire alarm system.

**3.3. START-UP AND TESTING**

- A. Starting Procedures: Follow manufacturer's written procedures. If no procedures are prescribed by manufacturer, proceed as follows:
  - 1. Verify that specialty valves, trim, fittings, controls, and accessories have been installed correctly and operate correctly.
  - 2. Verify that specified tests of piping are complete.
  - 3. Check that damaged sprinkler and sprinklers with paint or coating not specified have been replaced with new, correct type of sprinklers.
  - 4. Check that sprinklers are correct type, have correct finish and temperature ratings, and have guards where required for applications.
  - 5. Check that potable water supplies have correct type of backflow preventer.
  - 6. Check that hose valves and fire department connections have threads compatible with local fire department equipment and have correct pressure rating.
  - 7. Fill wet-pipe sprinkler systems with water.
  - 8. Energize circuits to electrical equipment and devices.
  - 9. Adjust operating controls and pressure settings.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. DESCRIPTION OF WORK**

- A. This Section specifies the basic requirements for all Contractor installed equipment. It applies to all sections included in Division 22. The requirements herein are an expansion upon the requirements of Division 1.
- B. Provide all materials, labor and equipment required to install complete and fully operational plumbing systems as indicated by the contract drawings and this specification.
- C. Obtain and pay for all permits, licenses, fees and taxes applicable to this project as required by law.
- D. Cooperate with other trades in furnishing material and information required for installation and operation of mechanical items.
- E. Requirements for the following are included:
  - 1. Related work (other Contract Documents and specification sections) that must be combined with the requirements of this Section.
  - 2. Design performance.
  - 3. Delivery, storage, and handling.
  - 4. Quality assurance and standards.
  - 5. Submittals.
  - 6. Product quality, basic type, and finishes.
  - 7. Equipment identification.
  - 8. Excavation and backfill.
  - 9. Installation.
  - 10. Mounting and shimming.
  - 11. Inspection.
  - 12. Safety considerations.
  - 13. Cleaning, startup, and adjustments.

**1.2. RELATED WORK**

- A. This general section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total requirements for the project equipment and systems:
  - 1. Division 1 sections included in this Project specifications.
  - 2. The Contract.
  - 3. General and specific mechanical specifications and drawings included in the project.

**1.3. DEFINITIONS**

- A. “Indicated”: Refers to graphic representations, notes or schedules in the Drawings; or to other paragraphs or schedules in Specifications and similar requirements in the Contract Documents.
  - 1. Terms such as “shown”, “noted”, “scheduled”, and “specified”, are used to notify or help the user to locate reference. Location is not limited.

**BASIC PLUMBING REQUIREMENTS**

- B. “Directed”: Terms such as “directed”, “Requested”, “authorized”, “selected”, “approved”, “required”, and “permitted” mean directed by Architect/Engineer, approved by Architect/Engineer and similar phrases.
- C. “Approved”: When used in conjunction with Architect/Engineer's action on contract submittals, applications, requests, is limited to Architect/Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- D. “Regulations”: Includes laws, ordinances, statutes and lawful orders issued by authorities having jurisdiction, as well as rules, conventions and agreements within the construction industry that control performance of Work.
- E. “Furnish”: Means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation and similar operations.
- F. “Install”: Describes operations at Project site including actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, supporting, isolating, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations.
- G. “Provide”: Means to furnish and install.
- H. “Installer”: A contractor, or another entity engaged by the contractor, either as an employee, subcontractor, or contractor of a lower tier, to perform a particular construction activity including installation, erection, application or similar operations.
  - 1. Installers are required to be experienced in operations they are engaged to perform.
  - 2. The term “experience” means having successfully completed a minimum of three previous projects similar in scope and size to this Project and within the time frame indicated in the “Quality Assurance” section of the Specifications. In addition, it means being familiar with special requirements indicated and having complied with requirements of authorities having jurisdiction.
- I. “Project Site”: Is defined as the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of Project.

**1.4. DESIGN PERFORMANCE**

- A. Compliance by the Contractor and/or Vendor with the provisions of this Specification does not relieve him of the responsibilities of furnishing equipment and materials of proper design, mechanically suited to meet operating guarantees at the specified service conditions.

**1.5. SUBMITTALS**

- A. Product Data: Submit complete sets of manufacturer's product data in .PDF format for approval. All submittals are to be received in no more than (3) three packages. See Division 1 for further information regarding submittal requirements. Literature submitted shall clearly indicate the model number, capacity, rated operating conditions, noise levels, size, weight, support requirements, rough-in data and dimensions, electrical power requirements, wiring diagrams, utility (fuel, air, cooling water, etc.) requirements, and options furnished. Submittals shall include, but are not necessarily limited to the following;

**BASIC PLUMBING REQUIREMENTS**

1. Plumbing: Piping and insulation; Plumbing fixtures, including trim; insulation; valves; hangers and supports; equipment bases; isolators; water heaters; booster pumps and the like.
- B. Operation and Maintenance Data: Submit three complete sets of manufacturer's literature in .PDF format for approval. Data shall include installation, start-up, and maintenance instructions, parts lists, and wiring diagrams. Include all material on a CD-ROM or USB device.
- C. Substitutions: System design was based upon the equipment and materials listed on the drawings and specifications herein. At contractor's option, another manufacturer's equipment of similar quality, capacity and features may be submitted for prior approval per Section 01 60 00. Prior permission to substitute does not relieve the contractor of the responsibility of including this information in the bound submittal packages.

**1.6. QUALITY ASSURANCE**

- A. Codes and Standards: Comply with the provisions of the following codes, standards and specifications, except where more stringent requirements are shown or specified:
  1. State of Oregon "IBC".
  2. State of Oregon "IMC".
  3. State of Oregon "UPC".
  4. State of Oregon "IFC".
  5. ANSI/ASHRAE 90 - "Energy Efficient Design of New Buildings...."
  6. ANSI B31.9 "Building Service Piping".
  7. NFPA - 54 and 90B.
- B. Drawings: All drawings are diagrammatic and show general design, arrangement, and extent of the systems. Do not scale drawings for rough-in dimensions, nor use as shop drawings.
- C. Installer Qualifications: Company specializing in performing the work required with a minimum of five years documented experience.
- D. Contractor shall furnish and install all work in accordance with manufacturers' recommendations and instructions.

**1.7. DELIVERY, STORAGE AND PROTECTION**

- A. Delivery: Deliver to site with manufacturer's labels intact and legible.
- B. Preparation for shipment:
  1. Each unit shall be suitably prepared for the shipment specified and for storage in accordance with manufacturer's instructions in a manner requiring no disassembly prior to operation.
  2. The Contractor shall be solely responsible for the adequacy of the Preparation for Shipment provisions employed with respect to materials and application.
  3. One complete set of Installations, Operating and Maintenance Instructions shall be packed and shipped with the equipment. This set is in addition to the sets that are to be sent directly to the Owner.
- C. Handling: Avoid damage. Comply with manufacturer's installation instruction requirements for rigging, unloading and transporting units.

**BASIC PLUMBING REQUIREMENTS**

- D. Storage: Inside protected from weather, dirt and construction dust. Where necessary to store outside, elevate well above grade and enclose with durable, waterproof wrapping. Cap all pipe ends. Taping pipe ends is not adequate or allowable.

**1.8. PROJECT CONDITIONS**

- A. General: Provide products which are compatible with other portions of the work and provide products with the proper power characteristics and similar adaptations for the project.
- B. Arrangement: Arrange piping parallel with primary lines of the building construction and with a minimum 7 feet overhead clearance in unfinished equipment rooms where possible. Conceal all piping where possible unless indicated otherwise. Locate operating and control equipment properly to provide easy access for operation and maintenance. Give right-of-way to piping which must be sloped for drainage. Set all equipment level or as recommended by manufacturer.
- C. Coordination: Where several elements of the work must be sequenced and positioned in order to fit the available space, prepare shop drawings showing the actual physical dimensions (at accurate scale) required for installation and submit prior to purchase/fabrication/installation of any of the elements involved in the coordination.

**1.9. STANDARDS**

- A. General: Provide all new materials and equipment, identical to apparatus or equipment in successful operation for a minimum of five years. Provide materials of comparable quality omitted here but necessary to complete the work. Maximum allowable variation from stated capacities, minus 5% to plus 10% as approved in each case.
- B. Governing Standards: The following are typical standards generally referenced in these specifications and identified by their acronym. Federal Specifications (FS), American Society for Testing Materials (ASTM), American National Standards Institute (ANSI), Manufacturer's Standardization Society of the Valve and Fitting Industry, Standard Practice (MSS SP-69), Cast Iron Soil Pipe Institute (CISPI), Underwriters Laboratory (UL) numbers are given.

**1.10. WARRANTIES**

- A. Contractor shall provide a 1 year warranty on all equipment, materials and workmanship for a period of one year from the date of owner's acceptance.

**PART 2 PRODUCTS (NOT USED)****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. Verify all



**BASIC PLUMBING REQUIREMENTS**

- indicated elevations, building measurements, rough-in dimensions and equipment locations before proceeding with any work.
- B. Utility Locations: The location of all utilities, wires, conduits, pipes, ducts, or other service facilities are shown in a general way only on the drawings and in some instances are taken from existing drawings. 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.
  - C. Discrepancies: Any error, conflict or discrepancy in Drawings, Specifications and/or existing conditions shall be reported immediately. Do not proceed with any questionable items of work until clarification of same has been made. Should rearrangement or re-routing of piping or ductwork be necessary, provide for approval the simplest layout possible for that particular portion of the work. Under no circumstances shall beams, girders, footings or columns be cut for mechanical items. Casting of pipes into concrete is prohibited unless so shown on Drawings.
  - D. The Contractor shall cooperate with others to avoid interferences and delays in the construction work.
  - E. Interference as a result of poor coordination or lack of cooperation with other trades shall be corrected at the Contractor's expense.

**3.2. CUTTING AND PATCHING**

- A. General: Perform cutting and patching in accordance with Division 1.
- B. Protection: During cutting and patching, protect adjacent installations. Provide temporary barriers to prevent the spread of dust and dirt outside of the immediate work area.
- C. Repair: Patch finished surfaces and building components using new materials to match the existing.
- D. Inspection: Upon written direction from the Architect, uncover and restore work to provide for observation of concealed work.

**3.3. EXCAVATION AND BACKFILL**

- A. General: Perform all necessary excavation and backfill required for the installation of mechanical work. Any piping or other work damaged by the Contractor's operations shall be repaired at the Contractor's expense.
- B. Water: Keep all excavations free of standing water. Excavations damaged or softened by water or frost shall be re-excavated and filled back to original level with approved material at the Contractor's expense.
- C. Test: During the progress of the work for compacted fill, the Owner reserves the right to request compaction tests made under the direction of a testing laboratory.
- D. Trench Excavation: Excavate trenches to the necessary depth and width, removing rocks, unstable soil (silt, peat, etc.) roots and stumps. Width of trench shall be adequate for proper installation of piping or conduit.
- E. Foundation and Bedding:
  - 1. Proper preparation of foundation, placement of foundation material where required, and placement of bedding material shall precede the installation of the pipe. This shall include leveling of the trench bottom as well as placement and

**BASIC PLUMBING REQUIREMENTS**

- compaction of required bedding material to a uniform grade so that piping rests upon a continuous and uniform bedding.
2. Where excavation has been made below the required grade, the Contractor shall provide, place and compact suitable bedding material to restore the proper grade elevation.
- F. Provide tracer wire over top of piping.
1. Construction:
    - a. Conductor: Solid or stranded copper per spec ASTM B-3.
    - b. Insulation: High Molecular Weight Polyethylene (HMWPE) ASTM D-1248. Various insulation colors dependant on usage.
    - c. Temperature: 70 degrees C dry and wet.
    - d. Voltage: 20 and 30 Mil = 30 to 300 volts. 45 Mil = 600 volts.
- G. Backfilling: Upon acceptance of installed piping systems, trenches shall be backfilled in lifts. Backfill material shall be placed and compacted in lifts not to exceed 6 inches in depth to a height of 1 inch above the top of trench. Backfill shall be placed to obtain contact with the entire periphery of the pipe without disturbing pipe placement.
- H. Compaction: One of the following methods or combination thereof shall be required; 1) Mechanical Tamper or Vibratory Compactor. Compaction shall be sufficient to attain 95% of maximum density at optimum moisture content. Water "puddling" or "washing" is prohibited.
- I. Bedding/Backfill Material: Where native material has been removed, necessary foundation material consisting of 3/4 inch minus crushed rock or fill sand shall be placed and compacted to form a firm base of the required thickness. Backfill material shall be the same. Follow the pipe manufacturer's installation instructions when specified materials are specifically prohibited.

**3.4. MECHANICAL EQUIPMENT WIRING**

- A. Provide all motor starters, control devices, and wiring complete from power source indicated on Drawings.
- B. Equipment and systems shown on the Drawings and/or specifications, 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 controls for the actual selected equipment/system.

**3.5. INSTALLATION**

- A. Locating and Positioning Equipment: Observe all Codes and Regulations and good common practice in locating and installing mechanical equipment and material so that completed installation presents the least possible hazard. Maintain recommended clearances for repair and service to all equipment.
- B. Anchorage: Anchor and/or brace all mechanical equipment, piping to resist displacement due to seismic action, include snubbers on equipment mounted on spring isolators.
- C. Where mounting heights or locations are not identified, install systems, equipment and materials to provide maximum headroom.

**BASIC PLUMBING REQUIREMENTS**

- D. Provide clearance for installation of insulation and access to valves, fittings, damper actuators, etc. on pipe and duct systems.
- E. Install systems, materials and equipment giving right of way to systems required to be installed at a specific slope or operation by gravity.
- F. Flush clean and disinfect domestic water system.
- G. Provide chrome plated rigid or flexible supplies to fixtures with stops, reducers, and escutcheons.
- H. Provide trap primers and piping for floor drains and floor sinks.
- I. Installation shall be in accordance with the requirements of the equipment manufacturer, including special requirements for seismic restraints.
- J. Equipment Manufacturer's Responsibility and Services:
  - 1. A manufacturer's representative for major equipment and operating systems shall be provided as necessary to assist the Contractor during installation, and to provide written certification that the equipment has been installed as specified and in accordance with the manufacturer's representative.
  - 2. The manufacturer's representative shall provide the initial startup of equipment in the presence of the Owner.
    - a. Provide a pre-start check of all piping, valves, control devices, control panels, and equipment.
    - b. Calibrate and adjust equipment and controls for operation at the specified design and conditions.
    - c. Provide a record of all startup events noting problems and their resolution.
    - d. Provide a record of all set points for operational controls and devices.
  - 3. Upon the completion of the equipment startup, provide instructional time with the Owner's personnel to review the operations and maintenance manuals and perform each step necessary for startup, shutdown, troubleshooting, and routine maintenance. The instructional time shall be scheduled through the Owner.
  - 4. Upon completion of the inspections, startup, testing, and checkout procedures, the equipment manufacturer shall submit written notice to the Owner that the units are ready for use by the Owner. Provide a certificate of calibration for all equipment.

**3.6. MOUNTING AND SHIMMING**

- A. Mount equipment as shown on the Drawings, or per manufacturer requirements.
- B. Level the equipment by means of 304 stainless steel wedges (stainless steel plates and stainless steel shims). Wedge taper shall not be greater than 1/4 inch per foot. Use double wedges to provide a level bearing surface for the equipment. Secure each pair of wedges in their final positions with one tack weld on each side after leveling is complete. Wedging shall be executed in a manner that will prevent a change in level or springing of the Baseplate when the anchor bolts are tightened.

**3.7. INSPECTION**

- A. The Contractor shall inspect his work to ensure the installation and workmanship is in accordance with these specifications and acceptable industry standards for the work being done.

**BASIC PLUMBING REQUIREMENTS**

- B. All materials, equipment, and workmanship shall be subject to inspection at any time by the Owner. Contractor shall correct any work, materials, or equipment not in accordance with the Contract Documents.

**3.8. SAFETY CONSIDERATIONS**

- A. All equipment shall be installed with suitable access clearances that satisfy OSHA and code requirements for maintenance or removal of replaceable parts and components, and with necessary unions or flanges to perform the maintenance or removal without removing the connecting appurtenances.
- B. Where equipment requiring periodic maintenance cannot be reached by normal walkways because of interference with ductwork, piping, or other obstructions the Contractor shall notify the Owner and propose an alternate safe means of access. These may include construction of an overhead platform with stairway or ladder ends and safety railings or handholds, or walk-through duct plenums with hinged access doors, or as required to meet OSHA standards for safe maintenance procedures.

**3.9. CLEANING, START-UP, AND ADJUSTING**

- A. The Contractors shall be responsible for proper operation of all systems, minor subsystems, and services provided under this section. He shall coordinate start-up procedures, calibration, and system checkout with all project managers. Any system operational problems shall be diagnosed; all correctional procedures shall be initiated as required to bring out the system into compliance with the design, and the problem then shall be rechecked to verify that the system operates normally.
- B. Thoroughly clean all parts of the installation at the completion of the work. The Contractor shall clean up and remove from the premises all refuse material, crates, and rubbish arising from his work. Remove, clean, and reinstall all filters. Belt-drive tensions and alignments shall be checked. All motors and bearings shall be lubricated in accordance with the manufacturer's service manuals prior to equipment start-up. Provide a lubrication schedule for every item of equipment furnished under this section. The schedule shall include the type of lubricant and the application frequency.

**END OF SECTION**

**METERS AND GAUGES FOR PLUMBING PIPING****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Pressure gauges and pressure gauge taps.
- B. Thermometers and thermometer wells.

**1.2. RELATED REQUIREMENTS**

- A. Section 22 10 05 - Plumbing Piping.

**1.3. REFERENCE STANDARDS**

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.
- B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.
- C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014, with Editorial Revision (2017).

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.
- C. Project Record Documents: Record actual locations of components and instrumentation.
- D. Operation and Maintenance Data: Section 01 70 00.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements. for additional provisions.

**1.5. FIELD CONDITIONS**

- A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

**PART 2 PRODUCTS****2.1. PRESSURE GAUGES**

- A. Manufacturers:
  - 1. Weksler; Model 401: [www.weksler-gauges.com](http://www.weksler-gauges.com).
  - 2. Trerice; Model 700 Series: [www.trerice.com](http://www.trerice.com).
  - 3. Ametek (U.S. Gauge); Model Series 540: [www.ametekusg.com](http://www.ametekusg.com).
  - 4. Other approved manufacturers: Ashcroft, Marshalltown, Weiss.
  - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Pressure Gages: ASME B40.100, drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
  - 1. Case: Steel with brass bourdon tube.

**METERS AND GAUGES FOR PLUMBING PIPING**

2. Size: 4-1/2 inch diameter.
3. Mid-Scale Accuracy: One percent.
4. Scale: Psi and kPa.

**2.2. PRESSURE GAUGE TAPPINGS**

- A. Manufacturers:
  1. Weksler: [www.weksler-gauges.com](http://www.weksler-gauges.com).
  2. Trerice : [www.trerice.com](http://www.trerice.com).
  3. Ametek (U.S. Gauge): [www.ametekusg.com](http://www.ametekusg.com).
  4. Other approved manufacturers: Ashcroft, Marshalltown, Weiss.
  5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.
- C. Ball Valve: Brass 1/4 inch NPT cock, for 200 psi. Lever handle.
  1. Product: A12 manufactured by Weksler, or approved equal.
- D. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.
  1. Product: BBV4 manufactured by Weksler.
- E. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.
  1. Product: WG41/WG42 manufactured by Weksler.
- F. Syphon: Steel, Schedule 40, 1/4 inch angle or straight pattern.
  1. Product: AO31 manufactured by Weksler.

**2.3. STEM TYPE THERMOMETERS**

- A. Manufacturers:
  1. Weksler Glass Thermometer Corp: [www.wekslerglass.com](http://www.wekslerglass.com).
  2. Trerice; Model A00: [www.trerice.com](http://www.trerice.com).
  3. Ametek (U.S. Gauge); Model Fig. MN: [www.ametekusg.com](http://www.ametekusg.com).
  4. Other approved manufacturers: Ashcroft, Marshalltown, Weiss.
  5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Thermometers - Fixed Mounting: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish.
  1. Size: 9 inch scale.
  2. Window: Clear glass.
  3. Stem: 3/4 inch brass.
  4. Accuracy: 2 percent, per 1.
  5. Calibration: Degrees F.
- C. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
  1. Size: 9 inch scale.
  2. Window: Clear glass.
  3. Stem: 3/4 inch NPT brass.
  4. Accuracy: 2 percent, per 1.
  5. Calibration: Degrees F.

**METERS AND GAUGES FOR PLUMBING PIPING****2.4. THERMOMETER SUPPORTS**

- A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

**PART 3 EXECUTION****3.1. INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.
- C. Install pressure gages with pulsation dampers. Provide needle valve to isolate each gage. Extend nipples to allow clearance from insulation.
- D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- E. Coil and conceal excess capillary on remote element instruments.
- F. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- G. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- H. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- I. Locate test plugs adjacent to pressure gages and pressure gage taps.

**3.2. SCHEDULES**

- A. Pressure Gauges, Location and Scale Range:
1. Pumps, 0 to 150 psi.
  2. Sprinkler system, 0 to 250 psi.
  3. Backflow preventers, 0 to 150 psi.
- B. Stem Type Thermometers, Location and Scale Range:
1. Water zone supply and return, 0 to 200 degrees F.
  2. Domestic hot water supply and recirculation, 0 to 200 degrees F.

**END OF SECTION**

**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Pipe hangers and supports.
- B. Hanger rods.
- C. Flashing.
- D. Sleeves.
- E. Mechanical sleeve seals.
- F. Formed steel channel.
- G. Firestopping relating to mechanical work.
- H. Firestopping accessories.

**1.2. RELATED SECTIONS**

- A. Section 07 90 05 - Joint Sealers: Product requirements for sealant materials for placement by this section.
- B. Section 09 90 00 - Painting and Coating: Product and execution requirements for painting specified by this section.
- C. Section 22 10 05 - Plumbing Piping.
- D. Section 22 07 16 - Plumbing Equipment Insulation: Execution requirements for placement of hangers and supports specified by this section.

**1.3. REFERENCES**

- A. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers.
- B. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials; American Society for Testing and Materials.
- C. ASTM E119 - Method for Fire Tests of Building Construction and Materials; American Society for Testing and Materials.
- D. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops; American Society for Testing and Materials.
- E. UL 723 - Tests for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.
- F. UL 1479 - Fire Tests of Through-Penetration Firestops; Underwriters Laboratories Inc.

**1.4. DEFINITIONS**

- A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.



**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT****1.5. SYSTEM DESCRIPTION**

- A. Firestopping Materials: ASTM E119 and ASTM E814 (UL 1479) to achieve fire ratings of adjacent construction noted in Division 1 documents and in accordance with UL Design Numbers.
- B. Surface Burning: ASTM E84/UL 723 with maximum flame spread/smoke developed rating of 25/450.
- C. Firestop interruptions to fire rated assemblies, materials, and components.

**1.6. SUBMITTALS**

- A. Section 01 30 00 - Administrative Requirements: Submittal procedures.
- B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.
- C. Product Data:
  - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
  - 2. Firestopping: Submit data on product characteristics, performance and limitation criteria.
- D. Manufacturer's Installation Instructions:
  - 1. Hangers and Supports: Submit special procedures and assembly of components.
  - 2. Firestopping: Submit preparation and installation instructions.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- F. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

**1.7. QUALITY ASSURANCE**

- A. Perform Work in accordance with State of Oregon standards.
- B. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.
- C. Maintain one copy of the document on site.

**1.8. QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

**1.9. PRE-INSTALLATION MEETINGS**

- A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT****1.10. DELIVERY, STORAGE, AND HANDLING**

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

**1.11. ENVIRONMENTAL REQUIREMENTS**

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.
- C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.
- D. Provide ventilation in areas to receive solvent cured materials.

**1.12. FIELD MEASUREMENTS**

- A. Verify field measurements prior to fabrication.

**1.13. WARRANTY**

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.

**PART 2 PRODUCTS****2.1. PIPE HANGERS AND SUPPORTS**

- A. Manufacturers:
  - 1. Tolco Inc.
  - 2. Anvil.
  - 3. Michigan Hanger Company, Inc.
  - 4. PHD Manufacturing Co.
  - 5. Superstrut.
  - 6. Unistrut.
  - 7. Substitutions: Section 01 60 00 - Product Requirements.
- B. Plumbing Piping - DWV:
  - 1. Conform to ASME B31.9.
  - 2. Hangers for Pipe Sizes 1/2 to 2-1/2 inches: Carbon steel, adjustable swivel, split ring.
  - 3. Hangers for Pipe Sizes 3 inches and Larger: Carbon steel, adjustable, clevis.

**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
  5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
  6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
  7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  8. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.
- C. Plumbing Piping - Water:
1. Conform to ASME B31.9.
  2. Hangers for Pipe Sizes 1/2 to 2-1/2 inches (unless other noted): Carbon steel, adjustable swivel, split ring.
  3. Hangers for Cold Pipe Sizes 3 inches and Larger: Carbon steel, adjustable, clevis.
  4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
  5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
  6. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  7. Copper Pipe Support: Copper-plated, Carbon-steel ring.

**2.2. ACCESSORIES**

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

**2.3. FLASHING**

- A. Metal Flashing: 26 gage thick galvanized steel.
- B. Metal Counterflashing: 22 gage thick galvanized steel.
- C. Lead Flashing:
1. Waterproofing: 5 lb./sq. ft. sheet lead
  2. Soundproofing: 1 lb./sq. ft. sheet lead.
- D. Flexible Flashing: 1.85 inches thick sheet butyl; compatible with roofing.
- E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

**2.4. SLEEVES**

- A. Sleeves for Pipes Through Non-fire Rated Beams Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- B. Sealant: Acrylic; refer to Section 07 90 05 - Joint Sealers.
- C. Sleeves Through Rated Concrete Decks: ASTM E 814 (UL 1479), UL Classified for W, L, F, T, and FM approved. Hilti Model Series CP/CPS; HoldRite "Hydroflam" Pro Series, or 3M Fire Barrier Cast-In Devices.

**2.5. MECHANICAL SLEEVE SEALS**

- A. Manufacturers:
1. Thunderline Link-Seal, Inc. Model Series LS.

**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

2. NMP Corporation.
  3. Substitutions: Section 01 60 00 - Product Requirements.
- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

**2.6. FORMED STEEL CHANNEL**

- A. Manufacturers:
1. Unistrut Model Series P1000.
  2. Superstrut Model Series 1200.
  3. Michigan Hanger "O-Strut" Model A-12.
  4. Substitutions: Section 01 60 00 - Product Requirements.
- B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

**2.7. FIRESTOPPING**

- A. Manufacturers:
1. Specified Technology Inc. (STI) Model SpecSeal Series 100.
  2. Dow Corning Corp.
  3. Hilti Corp.
  4. International Protective Coating Corp.
  5. 3M fire Protection Products.
  6. Substitutions: Section 01 60 00 - Product Requirements.
- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
1. Silicone Firestopping Elastomeric Firestopping: Single or multiple component silicone elastomeric compound and compatible silicone sealant.
  2. Foam Firestopping Compounds: Single or Multiple component foam compound.
  3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
  4. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
  5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
  6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
  7. Firestop Pillows: Formed mineral fiber pillows.
- C. Color: As selected from manufacturer's full range of colors.

**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT****2.8. FIRESTOPPING ACCESSORIES**

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- B. Dam Material: Permanent:
  - 1. Mineral fiberboard.
  - 2. Mineral fiber matting.
  - 3. Sheet metal.
  - 4. Plywood or particle board.
  - 5. Alumina silicate fire board.
- C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- D. General:
  - 1. Furnish UL listed products.
  - 2. Select products with rating not less than rating of wall or floor being penetrated.
- E. Non-Rated Surfaces:
  - 1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
  - 2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

**PART 3 EXECUTION****3.1. EXAMINATION**

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.
- C. Verify openings are ready to receive firestopping.

**3.2. PREPARATION**

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Remove incompatible materials affecting bond.
- C. Install backing or damming materials to arrest liquid material leakage.
- D. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- E. Do not drill or cut structural members.

**3.3. INSTALLATION - PIPE HANGERS AND SUPPORTS**

- A. Install in accordance with ASME 31.9.
- B. Support horizontal piping as scheduled.

**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

- C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
- D. Place hangers within 12 inches of each horizontal elbow.
- E. Use hangers with 1-1/2 inches minimum vertical adjustment.
- F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- G. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- I. Support riser piping independently of connected horizontal piping.
- J. Provide copper plated hangers and supports for copper piping.
- K. Design hangers for pipe movement without disengagement of supported pipe.
- L. Prime coat exposed steel hangers and supports. Refer to Section 09 9000 - Painting and Coating. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- M. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 22 07 16 - Plumbing Equipment Insulation.

**3.4. INSTALLATION - EQUIPMENT**

- A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond all anchor bolts for supported equipment.

**3.5. INSTALLATION - FLASHING**

- A. Provide flexible flashing and metal counterflashing where piping penetrate weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inches sheet size. Fasten flashing to drain clamp device.
- D. Seal floor, and mop sink drains watertight to adjacent materials.
- E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

**3.6. INSTALLATION - SLEEVES**

- A. Exterior watertight entries: Seal with mechanical sleeve seals.
- B. Set sleeves in position in forms. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

- E. Where piping penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing or fire-stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- F. Install chrome plated steel escutcheons at finished surfaces.

**3.7. INSTALLATION - FIRESTOPPING**

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items, requiring firestopping.
- B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
- C. Apply fire-stopping material in sufficient thickness to achieve required fire and smoke rating to uniform density and texture.
- D. Compress fibered material to maximum 40 percent of its uncompressed size.
- E. Place foamed material in layers to ensure homogenous density, filling cavities and spaces.
- F. Place sealant to completely seal junctions with adjacent dissimilar materials.
- G. Place intumescent coating in sufficient coats to achieve rating required.
- H. Remove dam material after firestopping material has cured.
- I. Fire Rated Surface:
  - 1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
    - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
    - b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
    - c. Pack void with backing material.
    - d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
    - e. Where cable tray, bus, cable bus, conduit, wire-way, trough, penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.
- J. Non-Rated Surfaces:
  - 1. Seal opening through non-fire rated wall, partition, floor, ceiling and roof opening as follows:
    - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
    - b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
    - c. Install type of firestopping material recommended by manufacturer.
    - d. Install escutcheons, floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
    - e. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.

**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

- f. Interior partitions: Seal pipe penetrations at clean rooms, laboratories, hospital spaces, computer rooms, telecommunication rooms, data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

**3.8. FIELD QUALITY CONTROL**

- A. Section 01 40 00 - Quality Requirements, and []: Field inspecting, testing, adjusting, and balancing.
- B. Inspect installed firestopping for compliance with specifications and submitted schedule.

**3.9. CLEANING**

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Clean adjacent surfaces of firestopping materials.

**3.10. PROTECTION OF FINISHED WORK**

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

**END OF SECTION**



**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Seismic restraint of equipment and piping.

**1.2. RELATED SECTIONS**

- A. Section 22 00 00 - Basic Plumbing Requirements.
- B. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.
- C. Section 22 07 19 - Plumbing Piping Insulation.
- D. Section 22 10 05 - Plumbing Piping.
- E. Section 22 30 00 - Plumbing Equipment.
- F. Section 22 40 00 - Plumbing Fixtures.

**1.3. QUALITY ASSURANCE**

- A. Seismic Restraints:
  - 1. The Anchorage and/or seismic restraint of permanent equipment and associated systems listed below shall be designed to resist the total design seismic forces prescribed in the latest edition of the International Building Code.
    - a. All floor or roof-mounted equipment weighing 400 lbs or greater.
    - b. All suspended or wall-mounted equipment weighing 20 lbs or greater.
    - c. All vibration-isolated equipment weighing 20 lbs or greater.
    - d. All gas piping systems throughout the building.
    - e. All piping 1 1/4 inches nominal diameter and larger located in boiler, mechanical equipment and refrigeration mechanical rooms.
    - f. All piping 2 1/2 inches nominal diameter and larger.
    - g. Pipes, electrical conduit and ducts supported by a trapeze where none of those elements would individually require bracing, require bracing when the combined operating weight of all elements supported by the trapeze is 10 lbs/ft or greater.
- B. All calculations shall be in accordance with Chapter 16 of the latest edition of the International Building Code.

**1.4. SUBMITTALS**

- A. Submit the following in accordance with Section 01 30 00:
  - 1. All anchorage and seismic restraints shall be designed and stamped by a professional engineer licensed in the state of the project location. Design shall include:
    - a. Number, size and location of anchors for floor or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both the unit to the curb and the curb to the structure. In addition, provide calculations or test data verifying the curb can accept the seismic loads.

**PLUMBING SEISMIC RESTRAINT**

- b. Number, size and location of seismic restraint devices and anchors for vibration-isolated and suspended equipment. Provide calculations or test data verifying the horizontal and vertical ratings of the seismic restraint devices.
- c. Number, size and location of braces and anchors for suspended piping and ductwork on shop drawings. In addition:
  - 1. The contractor must select a single seismic restraint system pre-designed to meet the requirements of the latest edition of the International Building Code such as the 2011 Mason Industries Seismic Restraint Guidelines for Suspended Piping, Ductwork, Electrical Systems and floor and roof mounted equipment.
  - 2. Details or designs from separate seismic restraint guidelines are not acceptable. Installations not addressed by the selected system must be designed, detailed and submitted along with the shop drawings.
  - 3. Maximum seismic loads shall be indicated on drawings at each brace location. Drawings shall bear the stamp and signature of the registered professional engineer licensed in the state of the project location who designed the layout of the braces.

**PART 2 PRODUCTS****2.1. MANUFACTURERS**

- A. Amber Booth.
- B. Mason Industries, Inc.
- C. Kinetics Corporation.
- D. Vibrex.
- E. Substitutions: Under provisions of Section 01 60 00.

**2.2. SEISMIC RESTRAINTS**

- A. General Requirements:
  - 1. Seismic restraints shall be provided for all equipment, both supported and suspended, piping and ductwork as listed above.
  - 2. Bracing of piping and ductwork shall be in accordance with provisions set forth in SMACNA seismic restraint manual.
  - 3. Structural requirements for restraints, including their attachment to building structure, shall be reviewed and approved by the structural engineer.
  - 4. Attachments to supported or suspended equipment must be coordinated with the equipment manufacturer.
- B. Supported Equipment Products:
  - 1. Seismic restraints shall consist of interlocking steel members restrained by shock absorbent neoprene materials compounded to bridge bearing specifications as previously noted in paragraph 1.03. Elastomeric materials shall be replaceable and be a minimum 3/4-inch thick. Snubbers shall be manufactured with an air gap

**PLUMBING SEISMIC RESTRAINT**

between hard and resilient material of not less than 1/8-inch, nor more than 1/4-inch. Type 1 - Seismic Snubbers: All-directional seismic snubbers shall consist of interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene. Bushing shall be replaceable and a minimum of 1/4 inch thick. A minimum air gap of 1/8 inch shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces. Snubber end caps shall be removable to allow inspection of internal clearances. The snubber shall be designed to accept horizontal and vertical seismic loads as defined in Section 1.03.B. Mason Type Z-1225 or Z-1011.

2. Each snubber shall be capable of restraint in all three mutually orthogonal directions. Type 2 - Seismic Sway Braces - Seismic sway braces shall consist of galvanized steel aircraft cables or steel angles/channels. Cables braces shall be designed to resist seismic tension loads and steel braces shall be designed to resist both tension and compression loads with a minimum safety factor of 2. Brace end connections shall be steel assemblies that swivel to the final installation angle. Do not mix cable and steel braces to brace the same system or equipment. Steel angles, when required, shall be clamped to the threaded hanger rods at the seismic sway brace locations utilizing a minimum of two ductile iron clamps. Sway braces shall be designed to accept horizontal and vertical seismic loads as defined in Section 1.03.B. Mason Type SCB, SSB, SRC and UC.
3. Submittals shall include load versus deflection curves up to 1/2-inch on the x, y and z planes.
4. Mason Model Z-1011

C. Bracing of Pipes:

1. Provide seismic bracing of all piping as detailed below. (Exception: Piping suspended by individual hangers 12 inches or less in length, as measured from the top of the pipe to the bottom of the support where the hanger is attached, need not be braced).
  - a. Brace all gas piping.
  - b. Brace all piping located in boiler rooms, mechanical equipment rooms, and refrigeration mechanical rooms that is 1-1/4-inch nominal diameter and larger.
  - c. Brace all pipes 2-1/2-inch nominal diameter and larger.
2. For all gas piping, as specified in 1(a) the bracing details, schedules, and notes may be used, except that transverse bracing shall be at 20 feet maximum, and longitudinal bracing shall be at 40 feet maximum.
3. Seismic braces for pipes on trapeze hangers may be used.
4. Provide flexibility in joints where pipes pass through building seismic joints or expansion joints or where rigidly supported pipes connect to equipment with vibration isolators. For threaded piping, the flexibility may be provided by the installation of swing joints.
5. Cast iron pipe of all types, glass pipe, and any other pipe jointed with a shield and clamp assembly, where the top of the pipe is 12 inches or more from the

**PLUMBING SEISMIC RESTRAINT**

- supporting structure, shall be braced on each side of a change in direction of 90 degrees or more. Riser joints shall be braced or stabilized between floors.
6. Vertical risers shall be laterally supported with a riser clamp at each floor. For buildings greater than six stories high, all risers shall be engineered individually.
- D. Suspended Equipment and Piping:
1. Cable Method: The seismic restraint shall consist of a combination of stranded steel aircraft cable and the specified vibration isolation hanger with an added nut and neoprene and steel washer. The cable resists lateral and downward motion. The modified vibration hanger resists upward motion.
  2. Cable attachment details, cable size, and the neoprene and steel washers shall be sized by the manufacturer and are to be indicated in the Shop Drawings.
  3. Provide detailed Shop Drawings for approval in sufficient time to allow structural attachment work to be incorporated into the normal work sequence.

**PART 3 EXECUTION****3.1. SEISMIC RESTRAINTS**

- A. General:
1. Install and adjust seismic restraints so that the equipment, piping, and ductwork supports are not degraded by the restraints.
  2. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise.
- B. Supported Equipment:
1. Each vibration isolation frame for supported equipment shall have a minimum of four seismic snubbers mounted as close as possible to the vibration isolators and/or the frame extremities.
  2. Care must be taken so that a minimum 1/8-inch air gap in the seismic restraint snubber is preserved on all sides in order that the vibration isolation potential of the isolator is not compromised. This requires that the final snubber adjustment be completed after the vibration isolators are properly installed and the installation approved.
- C. Bracing of Pipes:
1. Branch lines may not be used to brace main lines.
  2. Transverse bracing shall be at 40 feet maximum except where a lesser spacing is indicated in the SMACNA tables for bracing of pipes.
  3. Longitudinal bracing shall be at 80 feet maximum except where a lesser spacing is indicated in the tables. In pipes where thermal expansion is a consideration, an anchor point may be used as the specified longitudinal brace provided that it has a capacity equal to or greater than a longitudinal brace. The longitudinal braces and connections must be capable of resisting the additional force induced by expansion and contraction.
  4. A rigid piping system shall not be braced to dissimilar parts of the building or to two dissimilar building systems that may respond differently during an earthquake.

**PLUMBING SEISMIC RESTRAINT**

5. Transverse bracing for one pipe section may also act as longitudinal bracing for a pipe section of the same size connected perpendicular to it if the bracing is installed within 24 inches of the elbow or tee.
- D. Suspended Equipment and Piping Cable Method:
1. Cables shall be adjusted to a degree of slackness approved by the Structural Engineer.
  2. Uplift and downward restraint nuts and washers for the Type HST hangers shall be adjusted so that there is a minimum 1/4-inch clearance.

**END OF SECTION**

**IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Labels.
- E. Lockout devices.

**1.2. REFERENCE STANDARDS**

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.
- B. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.
- C. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

**1.3. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- F. Project Record Documents: Record actual locations of tagged valves.

**PART 2 PRODUCTS****2.1. MANUFACTURERS**

- A. Brady Corporation: [www.bradycorp.com](http://www.bradycorp.com).
- B. Safety Sign Company: [www.safetysignco.com](http://www.safetysignco.com).
- C. Seton Identification Products: [www.seton.com/aec](http://www.seton.com/aec).
- D. Substitutions: See Section 01 60 00 - Product Requirements.

**2.2. NAMEPLATES**

- A. Description: Laminated three-layer plastic with engraved letters.
  - 1. Letter Color: Black.
  - 2. Letter Height: 1/2 inch.
  - 3. Background Color: Yellow.
  - 4. Plastic: Comply with ASTM D709.

**IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT****2.3. TAGS**

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

**2.4. PIPE MARKERS**

- A. Comply with ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

**2.5. LABELS**

- A. Description: Aluminum, size 1.9 x 0.75 inches, adhesive backed with printed identification.

**2.6. LOCKOUT DEVICES**

- A. Lockout Hasps:
  - 1. Manufacturers:
    - a. Anodized aluminum or reinforced nylon hasp with erasable label surface; size minimum 7-1/4 x 3 inches.
- B. Valve Lockout Devices:
  - 1. Steel device preventing access to valve operator, accepting lock shackle.

**PART 3 EXECUTION****3.1. PREPARATION**

- A. Degrease and clean surfaces to receive adhesive for identification materials.

**3.2. INSTALLATION**

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.

**IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Identify tanks, and water treatment devices with 8 x 4 inch plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- G. Identify valves in main and branch piping with tags.
- H. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

**END OF SECTION**



**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Piping insulation.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping.
- B. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.
- C. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.

**1.3. REFERENCE STANDARDS**

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019.
- B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).
- C. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2013).
- D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2017.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
- F. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

**1.5. QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of documented experience.

**1.6. DELIVERY, STORAGE, AND HANDLING**

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

**1.7. FIELD CONDITIONS**

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

**PART 2 PRODUCTS**

**2.1. REGULATORY REQUIREMENTS**

- A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
- B. Materials shall not contain pentabrominated diphenyl ethers (PBDEs) in amounts greater than allowed by Oregon law.

**2.2. GLASS FIBER**

- A. Manufacturers:
  - 1. Knauf Insulation; Pipe Insulation ASJ-SSL: [www.knaufusa.com](http://www.knaufusa.com).
  - 2. Johns Manville; SSL II: [www.jm.com](http://www.jm.com).
  - 3. Owens Corning Corp: [www.owenscorning.com](http://www.owenscorning.com).
  - 4. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).
  - 5. Knauf Insulation: [www.knaufusa.com](http://www.knaufusa.com).
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation: ASTM C547 ; rigid molded, noncombustible.
  - 1. 'K' value: ASTM C177, 0.24 at 75 degrees F.
  - 2. Maximum service temperature: 850 degrees F.
  - 3. Maximum moisture absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
- D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- E. Vapor Barrier Lap Adhesive: Compatible with insulation.
  - 1. Compatible with insulation.
- F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
  - 1. ASTM C195; hydraulic setting on mineral wool.
- G. Indoor Vapor Barrier Finish:
  - 1. Cloth: Untreated; 9 oz/sq yd weight.
  - 2. Vinyl emulsion type acrylic, compatible with insulation, black color.
- H. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
  - 1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- I. Outdoor Breather Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
  - 1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- J. Insulating Cement: ASTM C449.

1. ASTM C449/C449M.

### **PART 3 EXECUTION**

#### **3.1. EXAMINATION**

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

#### **3.2. INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass fiber insulated pipes conveying fluids below ambient temperature:
  1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
  2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- G. Glass fiber insulated pipes conveying fluids above ambient temperature:
  1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
  2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- H. Inserts and Shields:
  1. Application: Piping 1-1/2 inches diameter or larger.
  2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
  3. Insert location: Between support shield and piping and under the finish jacket.
  4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
  5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

**PLUMBING PIPING INSULATION**

- J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

**3.3. SCHEDULES****A. Plumbing Systems:**

1. Domestic Hot Water Supply:
  - a. Glass Fiber, Rigid, Insulation:
    1. Pipe Size Range: Under 2 inch.
    2. Thickness: 1 inch.
    3. Pipe Size Range: Over 2 inch.
    4. Thickness: 1-1/2 inch.
2. Domestic Hot Water Recirculation:
  - a. Glass Fiber Insulation:
    1. Pipe Size Range: All sizes.
    2. Thickness: 1 inch.
3. Domestic Cold Water:
  - a. Glass Fiber, Rigid, Insulation:
    1. Pipe Size Range: 1 inch and under.
    2. Thickness: 1/2 inch.
    3. Pipe Size Range: Over 1 inch.
    4. Thickness: 1 inch.
4. Roof Drain Bodies: Flexible Duct Wrap with multi-purpose, foil-scrim-kraft jacket. Use tie-wire to secure in place. Minimum thickness: 1 inch.
5. Roof Drainage Within 10 Feet of the Exterior:
  - a. Glass Fiber, Rigid, Insulation:
    1. Pipe Size Range: All sizes.
    2. Thickness: 1 inch.
6. Roof Drainage Run Horizontal at Roof Level:
  - a. Glass Fiber, Rigid, Insulation:
    1. Pipe Size Range: All sizes.
    2. Thickness: 1 inch.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Pipe, pipe fittings, specialties, and connections for piping systems.
  - 1. Sanitary sewer.
  - 2. Domestic water.
  - 3. Storm water.
  - 4. Flanges, unions, and couplings.
  - 5. Ball valves.
  - 6. Valves.
  - 7. Flow controls.
  - 8. Check valves.
  - 9. Relief valves.
  - 10. Strainers.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping.
- B. Section 22 05 29 - Plumbing Hangers and Supports.
- C. Section 22 05 49 - Plumbing Seismic Restraint.
- D. Section 22 05 53 - Identification for Plumbing Piping and Equipment.
- E. Section 31 23 16 - Excavation.
- F. Division 26 - Equipment Wiring: Electrical characteristics and wiring connections.

**1.3. REFERENCE STANDARDS**

- A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
- B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.
- C. ASME B31.9 - Building Services Piping; 2014.
- D. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2007.
- E. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- F. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.
- G. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.
- H. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011 (Amended 2012).
- I. AWWA C651 - Disinfecting Water Mains; 2014.
- J. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009 (Revised 2012).
- K. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011 (Revised 2012).
- L. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.
- M. NSF 61 - Drinking Water System Components - Health Effects; 2020.
- N. NSF 372 - Drinking Water System Components - Lead Content; 2020.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Project Record Documents: Record actual locations of valves.

**1.5. QUALITY ASSURANCE**

- A. Perform work in accordance with all applicable local codes and standards.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

**1.6. REGULATORY REQUIREMENTS**

- A. Perform work in accordance with applicable plumbing code.
- B. Conform to applicable code for installation of backflow prevention devices.
- C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

**1.7. DELIVERY, STORAGE, AND HANDLING**

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. Store pipe on sleepers, a minimum of 4 inches above surrounding grade, at all times.

**PART 2 PRODUCTS**

**2.1. GENERAL REQUIREMENTS**

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

**2.2. SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING**

- A. Cast Iron Pipe: CISPI 301, hubless.
  - 1. Fittings: Cast iron.
  - 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies. Mission Heavyweight, Husky 4000, Clamp-All 120 system, Ideal Triden, or approved.

**2.3. SANITARY SEWER PIPING, ABOVE GRADE**

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
  - 1. Fittings: Cast iron.
  - 2. Joints: CISPI 310, ASTM 1277, neoprene gaskets and stainless steel clamp-and-shield assemblies.

**2.4. DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING**

- A. Copper Pipe: ASTM B42, annealed.
  - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
  - 2. Joints: AWS A5.8, BCuP silver braze.

**2.5. DOMESTIC WATER PIPING, ABOVE GRADE**

- A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
  - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
  - 2. Joints: ASTM B32, alloy Sn95 solder.

**2.6. STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING**

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
  - 1. Fittings: Cast iron.
  - 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies. Mission Heavyweight, Husky 4000, Clamp-All 120 system, Ideal Triden, or approved.

**2.7. STORM WATER PIPING, ABOVE GRADE**

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
  - 1. Fittings: Cast iron.
  - 2. Joints: CISPO 310, ASTM 1277, Neoprene gaskets and stainless steel clamp-and-shield assemblies.

**2.8. FLANGES, UNIONS, AND COUPLINGS**

- A. Unions for Pipe Sizes 3 Inches and Under:
  - 1. Ferrous pipe: Class 150 malleable iron threaded unions.
  - 2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Size Over 1 Inch:
  - 1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
  - 2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

**2.9. GATE VALVES**

- A. Manufacturers:
  - 1. Hammond Valve Co.; Model IB640/IB641: [www.hammondvalve.com](http://www.hammondvalve.com).
  - 2. NIBCO, Inc.; T/S-111-LF: [www.nibco.com](http://www.nibco.com).
  - 3. Milwaukee Valve Company; Model 148/1150: [www.milwaukeevalve.com](http://www.milwaukeevalve.com).
  - 4. Stockham; Model B-100/B-122: [www.stockham.com](http://www.stockham.com).
  - 5. Apollo Valve; Model 101SLF/101TLF: [www.apollovalves.com](http://www.apollovalves.com).
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Up To and Including 3 Inches:
  - 1. MSS-SP-13, 300PSI CWP, lead free, bronze body and trim, rising stem, handwheel, inside screw, solid wedge disc, solder or threaded ends.

**2.10. BALL VALVES**

- A. Manufacturers:
  - 1. Hammond Valve Co.; Model 8501/8901: [www.hammondvalve.com](http://www.hammondvalve.com).
  - 2. NIBCO, Inc.; T/S-FP-600A / T/S-585-80-LF: [www.nibco.com](http://www.nibco.com).
  - 3. Watts; Model FBV-1/B-6000: [www.watts.com](http://www.watts.com).
  - 4. Stockham; Model S216-BR-R-T: [www.stockham.com](http://www.stockham.com).
  - 5. Apollo; Model 77CLF: [www.apollovalves.com](http://www.apollovalves.com).
  - 6. Milwaukee Valve Company; Model BA-125/BA-100: [www.milwaukeevalve.com](http://www.milwaukeevalve.com).
  - 7. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.
- C. Up to and including 3 inches:
  - 1. MSS SP 110, 600 PSI-CWP, bronze, two piece body, lead free brass ball, full port, teflon seats and stuffing box ring, blow-out proof stem, lever handle solder or threaded ends.

**2.11. FLOW CONTROLS**

- A. Manufacturers:
  - 1. NIBCO, Inc.; Model T/S-1805-LF: [www.nibco.com](http://www.nibco.com).
  - 2. ITT Bell & Gossett: [www.bellgossett.com](http://www.bellgossett.com).
  - 3. Griswold Controls: [www.griswoldcontrols.com](http://www.griswoldcontrols.com).
  - 4. Taco, Inc.: [www.taco-hvac.com](http://www.taco-hvac.com).
  - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.



- C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

## **2.12. SPRING LOADED CHECK VALVES**

- A. Manufacturers:
1. Hammond Valve; IR9354: [www.hammondvalve.com](http://www.hammondvalve.com).
  2. NIBCO, Inc.; Model F-910-LF: [www.nibco.com](http://www.nibco.com).
  3. Milwaukee Valve Company; Model Series 1800: [www.milwaukeevalve.com](http://www.milwaukeevalve.com).
  4. Apollo Valve; Model 910WB: [www.apollovalves.com](http://www.apollovalves.com).
  5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Class 125, globe style, iron body, bronze trim, stainless steel springs, bronze disc, seals, flanged ends.

## **2.13. RELIEF VALVES**

- A. Pressure Relief:
1. Manufacturers:
    - a. Watts Regulator Company: [www.wattsregulator.com](http://www.wattsregulator.com).
    - b. Cash-Acme: [www.cashacme.com](http://www.cashacme.com).
    - c. Zurn/Wilkins: [www.zurn.com](http://www.zurn.com).
    - d. Apollo Valve: [www.apollovalves.com](http://www.apollovalves.com).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
  2. AGA Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.
- B. Temperature and Pressure Relief:
1. Manufacturers:
    - a. Watts Regulator Company: [www.wattsregulator.com](http://www.wattsregulator.com).
    - b. Cash-Acme: [www.cashacme.com](http://www.cashacme.com).
    - c. Zurn/Wilkins: [www.zurn.com](http://www.zurn.com).
    - d. Apollo Valve: [www.apollovalves.com](http://www.apollovalves.com).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
  2. AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME (BPV IV) certified and labelled.

## **2.14. STRAINERS**

- A. Manufacturers:
1. Watts Regulator Company: [www.wattsregulator.com](http://www.wattsregulator.com).
  2. Hammond Valve: [www.hammondvalve.com](http://www.hammondvalve.com).
  3. Milwaukee Valve Company: [www.milwaukeevalve.com](http://www.milwaukeevalve.com).
  4. Apollo: [www.apollovalves.com](http://www.apollovalves.com).
  5. Stockham: [www.stockham.com](http://www.stockham.com).
  6. Substitutions: See Section 01 60 00 - Product Requirements.

- B. Size 2 inch and Under:
  - 1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
  - 2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
- C. Size 1-1/2 inch to 4 inch:
  - 1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

### **PART 3 EXECUTION**

#### **3.1. EXAMINATION**

- A. Verify that excavations are to required grade, dry, and not over-excavated.

#### **3.2. PREPARATION**

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

#### **3.3. INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed.
- I. Establish elevations of buried piping outside the building to ensure not less than 2 ft of cover.
- J. Provide tracer wire over top of piping.
  - 1. Construction:
    - a. Conductor: Solid or stranded copper per spec ASTM B-3.
    - b. Insulation: High Molecular Weight Polyethylene (HMWPE) ASTM D-1248. Various insulation colors dependant on usage.
    - c. Temperature: 70 degrees C dry and wet.
    - d. Voltage: 20 and 30 Mil = 30 to 300 volts. 45 Mil = 600 volts.
- K. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.
- L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

- M. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.
- N. Excavate in accordance with specifications.
- O. Backfill in accordance with specifications.
- P. Install valves with stems upright or horizontal, not inverted.
- Q. Install water piping to ASME B31.9.
- R. Sleeve pipes passing through partitions, walls, and floors.

### **3.4. APPLICATION**

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install gate valves for shut-off and to isolate equipment, or part of systems.
- D. Install globe valves for throttling, bypass, or manual flow control services.
- E. Provide spring-loaded check valves on discharge of water pumps.
- F. Provide flow controls in water recirculating systems where indicated.

### **3.5. TOLERANCES**

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.
- B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

### **3.6. DISINFECTION OF DOMESTIC WATER PIPING SYSTEM**

- A. Prior to starting work, verify system is complete, flushed, and clean.
- B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

### **3.7. SERVICE CONNECTIONS**

- A. Provide new sanitary sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service complete with approved reduced pressure backflow preventer and water meter, pressure reducing valve, and sand strainer.

1. Provide 18 gage, 0.0478-inch galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Floor drains and floor sinks.
- B. Trap primers.

**1.2. RELATED REQUIREMENTS**

- A. Section 22 10 05 - Plumbing Piping.
- B. Section 22 40 00 - Plumbing Fixtures.
- C. Section 22 30 00 - Plumbing Equipment.
- D. Division 26 - Equipment Wiring: Electrical characteristics and wiring connections.

**1.3. REFERENCE STANDARDS**

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
- D. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors.
- E. Operation Data: Indicate frequency of treatment required for interceptors.
- F. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. Extra Loose Keys for Outside Hose Bibbs: Two.

**1.5. QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

**1.6. DELIVERY, STORAGE, AND HANDLING**

- A. Accept specialties on site in original factory packaging. Inspect for damage.

**PART 2 PRODUCTS (ON THE DRAWINGS)**

**PART 3 EXECUTION**

**3.1. INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Install approved portable water protection devices on plumbing lines where contamination of domestic water may occur; on janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, and interior and exterior hose bibbs.
- F. Pipe relief from backflow preventer to nearest drain.
- G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatories sinks washing machine outlets.
- H. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.
- I. Install service shut-off valve for trap primers.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Pipe and pipe fittings.
- B. Air compressor.
- C. Air receiver and accessories.
- D. Refrigerated air dryer.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping.
- B. Section 22 05 49 - Plumbing Seismic Restraint.
- C. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Identification of piping system.
- D. Division 26: Electrical characteristics and wiring connections.

**1.3. REFERENCE STANDARDS**

- A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
- B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.
- C. ASME B31.9 - Building Services Piping; 2014.
- D. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- E. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.
- F. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers catalog literature with capacity, weight, and electrical characteristics and connection requirements.
- C. Test Reports: Submit inspector's certificate for air receiver for inclusion in Operating and Maintenance Manuals.
- D. Project Record Documents: Record actual locations of equipment and components. Modify shop drawings to indicate final locations.

**1.5. QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Pressure Vessels: Comply with applicable code for installation of pressure vessels.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

**1.6. DELIVERY, STORAGE, AND HANDLING**

- A. Accept air compressors, refrigerated air dryer on site in factory-fabricated containers with shipping skids and plastic pipe end protectors in place. Inspect for damage.

- B. Protect piping and equipment from weather and construction traffic.

**1.7. WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

**PART 2 PRODUCTS**

**2.1. PIPE AND PIPE FITTINGS**

- A. Copper Tube: ASTM B88 Type K (A), drawn.
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
  2. Joints: ASTM B32, solder, Grade Sn95.
- B. Aluminum Pipe:
1. Fittings.
  2. Joints.

**2.2. VALVES**

- A. Gate Valves:
1. Manufacturers:
    - a. Hammond Valve Co.; Model IB640/IB641: [www.hammondvalve.com](http://www.hammondvalve.com).
    - b. Nibco, Inc.; Model T-111/T-131: [www.nibco.com](http://www.nibco.com).
    - c. Milwaukee Valve Company; Model 148/1150: [www.milwaukeevalve.com](http://www.milwaukeevalve.com).
    - d. Stockham; Model B-100/B-122: [www.stockham.com](http://www.stockham.com).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
  2. Up To and Including 3 Inches:
    - a. MSS SP-80, Class 150, bronze body, bronze trim, rising stem, threaded bonnet, handwheel, inside screw, solid wedge disc, solder or threaded ends.
- B. Ball Valves:
1. Manufacturers:
    - a. Hammond Valve Co.; Model 8501/8901: [www.hammondvalve.com](http://www.hammondvalve.com).
    - b. Nibco, Inc.; Model T-FP-600/T-585-70: [www.nibco.com](http://www.nibco.com).
    - c. Watts; Model FBV-1/B-6000: [www.watts.com](http://www.watts.com).
    - d. Stockham; Model S216-BR-R-T: [www.stockham.com](http://www.stockham.com).
    - e. Apollo; Model 70-100: [www.conbraco.com](http://www.conbraco.com).
    - f. Milwaukee Valve Company; Model BA-125/BA-100: [www.milwaukeevalve.com](http://www.milwaukeevalve.com).
    - g. Substitutions: See Section 01 60 00 - Product Requirements.
  2. Up to and including 3 inches:
    - a. MSS SP 110, Class 150, 600 WOG, bronze, two piece body, chrome plated brass ball, full port, teflon seats and stuffing box ring, blow-out proof stem, lever handle solder or threaded ends.
- C. Swing Check Valves:



**GENERAL-SERVICE COMPRESSED-AIR SYSTEMS**

1. Manufacturers:
    - a. Hammond Valve; Model IB940/IR1124: [www.hammondvalve.com](http://www.hammondvalve.com).
    - b. Nibco, Inc.; Model T-413/F-918B: [www.nibco.com](http://www.nibco.com).
    - c. Stockham; Model B-320/G-931: [www.stockham.com](http://www.stockham.com).
    - d. Milwaukee Valve Company; Model F-2974: [www.milwaukeevalve.com](http://www.milwaukeevalve.com).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
  2. Up to 3 Inches:
    - a. MSS SP-80, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder or threaded ends.
- D. Air Outlets:
1. Quick Connector: 3/8 inch brass, snap on connector with self closing valve, Style A, L, T, or M.

**2.3. UNIONS AND COUPLINGS**

- A. Unions:
1. Copper Tube and Pipe: 150 psi bronze unions with soldered joints.
- B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
- C. Flexible Connector: Neoprene with brass threaded connectors.

**2.4. COMPRESSOR**

- A. Owner furnished, Contractor installed.

**2.5. AIR DRYER**

- A. Owner furnished, Contractor installed.

**2.6. AIR RECEIVER**

- A. Owner furnished, Contractor installed.

**PART 3 EXECUTION****3.1. INSTALLATION**

- A. Install equipment in accordance with manufacturer's instructions.
- B. Install compressor unit on concrete housekeeping pad.
- C. Install compressor unit on vibration isolators. Level and bolt in place.
- D. Make air cock and drain connection on horizontal casing.
- E. Install line size gate valve and check valve on compressor discharge.
- F. Install replaceable cartridge type filter silencer of adequate capacity for each compressor.
- G. Connect condensate drains to nearest floor drain.
- H. Install valved bypass around air dryer. Factory insulate inlet and outlet connections. Refer to Section 22 05 23.
- I. Install valved drip connections at low points of piping system.

**GENERAL-SERVICE COMPRESSED-AIR SYSTEMS**

- J. Install takeoffs to outlets from top of main, with shut off valve after takeoff. Slope takeoff piping to outlets.
- K. Install compressed air couplings, female quick connectors, and pressure gauges where outlets are indicated.
- L. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.
- M. Identify piping system and components.

**3.2. FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.1.
- C. Repair or replace compressed air piping as required to eliminate leaks, and retest to demonstrate compliance.
- D. Cap and seal ends of piping when not connected to mechanical equipment.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. In-line circulator pumps.
- B. Water heaters.
- C. Expansion Tanks.

**1.2. RELATED REQUIREMENTS**

- A. Section 22 10 05 - Plumbing Piping.
- B. Section 22 10 06 - Plumbing Piping Specialties.
- C. Division 26: Electrical characteristics and wiring connections.

**1.3. REFERENCE STANDARDS**

- A. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Current Edition, Including All Revisions.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.
- B. Product Data:
  - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
  - 2. Indicate pump type, capacity, power requirements.
  - 3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
  - 4. Provide electrical characteristics and connection requirements.
- C. Project Record Documents: Record actual locations of components.
- D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

**1.5. QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.
- C. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

**1.6. CERTIFICATIONS**

- A. Water Heaters: NSF approved.
- B. Electric Water Heaters: UL listed and labeled to UL 174.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

**1.7. DELIVERY, STORAGE, AND HANDLING**

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

**1.8. WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide 10 year manufacturer warranty for domestic water heaters.

**PART 2 PRODUCTS**

**2.1. WATER HEATER MANUFACTURERS**

- A. A.O. Smith Water Products Co: [www.hotwater.com](http://www.hotwater.com).
- B. Bradford-White: [www.bradfordwhite.com](http://www.bradfordwhite.com).
- C. Rheem Manufacturing Company: [www.rheem.com](http://www.rheem.com).
- D. Substitutions: See Section 01 60 00 - Product Requirements.

**2.2. COMMERCIAL ELECTRIC WATER HEATERS**

- A. Type: Factory-assembled and wired, electric, vertical storage.
- B. Performance:
  - 1. As indicated on Drawings.
- C. Electrical Characteristics:
  - 1. Refer to Division 26.
- D. Tank: Glass lined welded steel; 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber or polyurethane encased in corrosion-resistant steel jacket; baked-on enamel finish.
- E. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F, flanged or screw-in nichrome elements, high temperature limit thermostat.
- F. Accessories: Provide:
  - 1. Water connections: Brass.
  - 2. Dip tube.
  - 3. Drain Valve.
  - 4. Anode: Magnesium.
  - 5. Temperature and Pressure Relief Valve: ASME labelled.
- G. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 Watts per square inch.

**2.3. DIAPHRAGM-TYPE COMPRESSION TANKS**

- A. Manufacturers:
  - 1. Amtrol Inc.; Model ST-C: [www.amtrol.com](http://www.amtrol.com).
  - 2. ITT Bell & Gossett; PTA: [www.bellgossett.com](http://www.bellgossett.com).
  - 3. Taco, Inc.: [www.taco-hvac.com](http://www.taco-hvac.com).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge as indicated on drawings.

**2.4. IN-LINE CIRCULATOR PUMPS**

- A. Manufacturers:
  - 1. Armstrong Pumps Inc.: [www.armstrongpumps.com](http://www.armstrongpumps.com).
  - 2. ITT Bell & Gossett: [www.bellgossett.com](http://www.bellgossett.com).
  - 3. Taco, Inc.: [www.taco-hvac.com](http://www.taco-hvac.com).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.
- C. Impeller: Bronze.
- D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
- E. Seal: Carbon rotating against a stationary ceramic seat.
- F. Drive: Flexible coupling.
- G. Performance:
  - 1. Flow: \_\_\_\_\_ gpm, at \_\_\_\_\_ feet head.
  - 2. Electrical Characteristics:
    - a. Refer to Division 26.

**PART 3 EXECUTION**

**3.1. INSTALLATION**

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping work to achieve operating system.
- C. Domestic Water Storage Tanks:
  - 1. Provide steel pipe support, independent of building structural framing members.
  - 2. Clean and flush prior to delivery to site. Seal until pipe connections are made.
- D. Pumps:
  - 1. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.

2. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Water closets.
- B. Urinals.
- C. Lavatories.
- D. Sinks.
- E. Service sinks.
- F. Drinking fountains.
- G. Wash fountains.
- H. Emergency eye and face wash.

**1.2. RELATED REQUIREMENTS**

- A. Section 06 41 00 - Architectural Wood Casework: Preparation of counters for sinks; lavatory tops.
- B. Section 07 90 05 - Joint Sealers: Seal fixtures to walls and floors.
- C. Section 22 10 05 - Plumbing Piping.
- D. Section 22 10 06 - Plumbing Piping Specialties.
- E. Section 22 30 00 - Plumbing Equipment.
- F. Division 26 - Equipment Wiring: Electrical characteristics and wiring connections.

**1.3. REFERENCE STANDARDS**

- A. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
- B. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2014.
- C. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2013.
- D. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).
- E. ASME A112.18.1 - Plumbing Supply Fittings; 2018.
- F. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures; The American Society of Mechanical Engineers; 2008 (R2011).
- G. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2013.
- H. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2017.
- I. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures; 1994 (R2009).

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Manufacturer's Instructions: Indicate installation methods and procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

- E. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

**1.5. CLOSEOUT SUBMITTALS**

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.

**1.6. QUALITY ASSURANCE**

- A. Perform work in accordance with applicable codes.
- B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of this section with minimum three years experience.

**1.7. REGULATORY REQUIREMENTS**

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

**1.8. PRE-INSTALLATION MEETINGS**

- A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

**1.9. DELIVERY, STORAGE, AND HANDLING**

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Accept fixtures on site in factory packaging. Inspect for damage.
- C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

**1.10. WARRANTY**

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.



**PART 2 PRODUCTS (ON THE DRAWINGS)**

**PART 3 EXECUTION**

**3.1. EXAMINATION**

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- C. Verify that electric power is available and of the correct characteristics.
- D. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

**3.2. PREPARATION**

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

**3.3. INSTALLATION**

- A. Install work in accordance with all applicable codes.
- B. Install each fixture with trap, easily removable for servicing and cleaning.
- C. Provide chrome plated rigid or flexible supplies to fixtures with screwdriver stops, reducers, and escutcheons.
- D. Install components level and plumb.
- E. Install and secure fixtures in place with wall supports and bolts.
- F. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 90 05, color to match fixture.
- G. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.
- H. For ADA accessible water closets, install flush valve with handle to wide side of stall.

**3.4. INTERFACE WITH WORK OF OTHER SECTIONS**

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

**3.5. ADJUSTING**

- A. Section 01 70 00 - Execution Requirements: Testing, adjusting, and balancing.
- B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

**3.6. PROTECTION**

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. DESCRIPTION OF WORK**

- A. This Section specifies the basic requirements for all Contractor installed equipment. It applies to all sections included in Division 23. The requirements herein are an expansion upon the requirements of Division 1.
- B. Provide all materials, labor and equipment required to install complete and fully operational HVAC systems as indicated by the contract drawings and this specification.
- C. Obtain and pay for all permits, licenses, fees and taxes applicable to this project as required by law.
- D. Cooperate with other trades in furnishing material and information required for installation and operation of mechanical items.
- E. Requirements for the following are included:
  - 1. Related work (other Contract Documents and specification sections) that must be combined with the requirements of this Section.
  - 2. Design performance.
  - 3. Delivery, storage, and handling.
  - 4. Quality assurance and standards.
  - 5. Submittals.
  - 6. Product quality, basic type, and finishes.
  - 7. Equipment identification.
  - 8. Design criteria.
  - 9. Installation.
  - 10. Mounting and shimming.
  - 11. Inspection.
  - 12. Safety considerations.
  - 13. Cleaning, startup, and adjustments.

**1.2. RELATED WORK**

- A. This general section shall be used in conjunction with the following other specifications and related Contract Documents to establish the total requirements for the project equipment and systems:
  - 1. Division 1 sections included in this Project specifications.
  - 2. The Contract.
  - 3. General and specific mechanical specifications and drawings included in the project.

**1.3. DEFINITIONS**

- A. “Indicated”: Refers to graphic representations, notes or schedules in the Drawings; or to other paragraphs or schedules in Specifications and similar requirements in the Contract Documents.
  - 1. Terms such as “shown”, “noted”, “scheduled”, and “specified”, are used to notify or help the user to locate reference. Location is not limited.

**BASIC HVAC REQUIREMENTS**

- B. “Directed”: Terms such as “directed”, “Requested”, “authorized”, “selected”, “approved”, “required”, and “permitted” mean directed by Architect/Engineer, approved by Architect/Engineer and similar phrases.
- C. “Approved”: When used in conjunction with Architect/Engineer's action on contract submittals, applications, requests, is limited to Architect/Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- D. “Regulations”: Includes laws, ordinances, statutes and lawful orders issued by authorities having jurisdiction, as well as rules, conventions and agreements within the construction industry that control performance of Work.
- E. “Furnish”: Means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation and similar operations.
- F. “Install”: Describes operations at Project site including actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, supporting, isolating, applying, working to dimension, finishing, curing, protecting, cleaning and similar operations.
- G. “Provide”: Means to furnish and install.
- H. “Installer”: A contractor, or another entity engaged by the contractor, either as an employee, subcontractor, or contractor of a lower tier, to perform a particular construction activity including installation, erection, application or similar operations.
  - 1. Installers are required to be experienced in operations they are engaged to perform.
  - 2. The term “experience” means having successfully completed a minimum of three previous projects similar in scope and size to this Project and within the time frame indicated in the “Quality Assurance” section of the Specifications. In addition, it means being familiar with special requirements indicated and having complied with requirements of authorities having jurisdiction.
- I. “Project Site”: Is defined as the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of Project.

**1.4. DESIGN PERFORMANCE**

- A. Compliance by the Contractor and/or Vendor with the provisions of this Specification does not relieve him of the responsibilities of furnishing equipment and materials of proper design, mechanically suited to meet operating guarantees at the specified service conditions.

**1.5. SUBMITTALS**

- A. Product Data: Submit complete sets of manufacturer's product data in .PDF format for approval. All submittals are to be received in no more than (3) three packages. See Division 1 for further information regarding submittal requirements. Literature submitted shall clearly indicate the model number, capacity, rated operating conditions, noise levels, size, weight, support requirements, rough-in data and dimensions, electrical power requirements, wiring diagrams, utility (fuel, air, cooling water, etc.) requirements, and options furnished. Submittals shall include, but are not necessarily limited to the following;

**BASIC HVAC REQUIREMENTS**

1. HVAC: Boilers; chillers; pumps; air handling units; colling towers; fans; piping; valves; supports and anchors; louvers; grilles; diffusers; controls and the like.
  2. Calculations: Provide for factory selection and sizing of all noise attenuation; vibration; isolation; thermal expansion and seismic restraints; with good engineering practice. Include design criteria used and assumptions made.
- B. Operation and Maintenance Data: Submit three complete sets of manufacturer's literature bound in a three ring binder for approval. Data shall include installation, start-up, and maintenance instructions, parts lists, and wiring diagrams. Include all material on a CD-ROM or USB device.
- C. Substitutions: System design was based upon the equipment and materials listed on the drawings and specifications herein. At contractor's option, another manufacturer's equipment of similar quality, capacity and features may be submitted for prior approval per Section 01 60 00. Prior permission to substitute does not relieve the contractor of the responsibility of including this information in the bound submittal packages.
- D. When specified, prepare and submit shop drawings and prints of plans, sections, details and diagrams to minimum scale (1/4" = 1'-0"). Mechanical and pump rooms shall be 1/2" = 1'-0" minimum scale. Drawings shall be coordinated, dimensioned and indicate equipment, recommended clearances, pipe, duct, fire protection and electrical in relation to architectural and structural features. Include minor piping, drains, valves and the like. Indicate exact locations and elevations of valves, piping specialties, access doors, dampers and the like.
- E. Shop drawings shall be created and submitted on AutoCAD release 2017 or later.
- F. Air Balancing Report: Provide .PDF reports stating the design air and hydronic flow requirements per, air inlet and air outlet and the final adjusted airflow volume for the same.

**1.6. QUALITY ASSURANCE**

- A. Codes and Standards: Comply with the provisions of the following codes, standards and specifications, except where more stringent requirements are shown or specified:
1. State of Oregon "IBC".
  2. State of Oregon "IMC".
  3. State of Oregon "UPC".
  4. State of Oregon "IFC".
  5. ANSI/ASHRAE 90 - "Energy Efficient Design of New Buildings...."
  6. ANSI/ASHRAE 62 - "Ventilation for Acceptable Indoor Air Quality."
  7. NEBB - "Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems."
  8. SMACNA - "HVAC Duct Construction Standards".
  9. NFPA - Section 90B.
- B. Wherever the specification call for or describe materials or construction of better quality or larger sizes than are required by the above rules and regulations, these specifications shall govern. Should there be any direct conflict between the above rules and regulations and the specifications the rules shall govern.

**BASIC HVAC REQUIREMENTS**

- C. Drawings: All drawings are diagrammatic and show general design, arrangement, and extent of the systems. Do not scale drawings for rough-in dimensions, nor use as shop drawings.
- D. Installer Qualifications: Company specializing in performing the work required with a minimum of five years documented experience.
- E. Contractor shall furnish and install all work in accordance with manufacturers' recommendations and instructions.
- F. Equipment shall have U.L. label listing.

**1.7. MATERIALS AND SUBSTITUTIONS**

- A. Shop drawings of proposed material and equipment that differ from the specified basis of design materials and equipment shall be accompanied by shop drawings that define changes physical layout and performance. These drawings shall show modifications of architectural, plumbing, electrical and mechanical work required by the proposed materials and equipment such as relocation of flues, drains, piping, ducts, revised electrical circuits, relocation of roof or wall penetrations, revised foundations and the like.

**1.8. DELIVERY, STORAGE AND PROTECTION**

- A. Delivery: Deliver to site with manufacturer's labels intact and legible.
- B. Preparation for shipment:
  - 1. Each unit shall be suitably prepared for the shipment specified and for storage in accordance with manufacturer's instructions in a manner requiring no disassembly prior to operation.
  - 2. The Contractor shall be solely responsible for the adequacy of the Preparation for Shipment provisions employed with respect to materials and application.
  - 3. One complete set of Installations, Operating and Maintenance Instructions shall be packed and shipped with the equipment. This set is in addition to the sets that are to be sent directly to the Owner.
- C. Handling: Avoid damage. Comply with manufacturer's installation instruction requirements for rigging, unloading and transporting units.
- D. Storage: Inside protected from weather, dirt and construction dust. Where necessary to store outside, elevate well above grade and enclose with durable, waterproof wrapping. Cap all pipe ends. Taping pipe ends is not adequate or allowable.

**1.9. PROJECT CONDITIONS**

- A. General: Provide products which are compatible with other portions of the work and provide products with the proper power characteristics and similar adaptations for the project.
- B. Arrangement: Arrange ductwork and piping parallel with primary lines of the building construction and with a minimum 7 feet overhead clearance in unfinished equipment rooms where possible. Conceal all piping and ductwork where possible unless indicated otherwise. Locate operating and control equipment properly to provide easy access for

**BASIC HVAC REQUIREMENTS**

operation and maintenance. Give right-of-way to piping which must be sloped for drainage. Set all equipment level or as recommended by manufacturer.

- C. Coordination: Where several elements of the work must be sequenced and positioned in order to fit the available space, prepare shop drawings showing the actual physical dimensions (at accurate scale) required for installation and submit prior to purchase/fabrication/installation of any of the elements involved in the coordination.

**1.10. STANDARDS**

- A. General: Provide all new materials and equipment, identical to apparatus or equipment in successful operation for a minimum of five years. Provide materials of comparable quality omitted here but necessary to complete the work. Maximum allowable variation from stated capacities, minus 5% to plus 10% as approved in each case.
- B. Governing Standards: The following are typical standards generally referenced in these specifications and identified by their acronym. Federal Specifications (FS), American Society for Testing Materials (ASTM), American National Standards Institute (ANSI), Manufacturer's Standardization Society of the Valve and Fitting Industry, Standard Practice (MSS SP-69), Cast Iron Soil Pipe Institute (CISPI), Underwriters Laboratory (UL) numbers are given.
- C. Wherever the specifications call for or describe materials or construction of better quality or larger sizes than are required by the above standards or code, these specifications shall govern. For any direct conflict between the specifications and the above standards or codes, the standards and codes shall govern.

**1.11. WARRANTIES**

- A. Comply with Division 01 section - Project Closeout.
- B. Equipment under this section of the specifications shall be guaranteed for a period of one year from date of acceptance against defective materials, design, and workmanship.
- C. Contractor shall leave entire installation in complete working order and free from defects in material, workmanship, or finish.
- D. The HVAC contractor, by accepting these specifications and by signing the sub-contract, shall guarantee the following:
  - 1. All equipment, material, and workmanship against defects in material and workmanship for a period of one (1) year from date of final acceptance by the Owner. The HVAC contractor shall furnish written guarantee to replace defective work and materials furnished under this section, at no cost to the Owner, for this one (1) year period.
  - 2. That equipment and material will produce the results specified.
- E. The Owner reserves the right to make temporary repairs as necessary to keep equipment in operating condition without voiding the guarantees or relieving responsibility during the guarantee period.
- F. Provide, at no cost to the Owner, one qualified service technician for an 8-hour period after a period of 90 calendar days from date of acceptance of systems by Owner to repair, replace any latent deficiency.

**PART 2 PRODUCTS (NOT USED)**

**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. Verify all indicated elevations, building measurements, rough-in dimensions and equipment locations before proceeding with any work.
- B. Utility Locations: The location of all utilities, wires, conduits, pipes, ducts, or other service facilities are shown in a general way only on the drawings and in some instances are taken from existing drawings. 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.
- C. The inclusion and proper location of supports, pads, sleepers, openings, anchoring and the like provided by others is the responsibility of the contractor under this section. Cutting and/or boring shall be permitted under this section only with the written approval of the Architect.
- D. It shall be the contractor's responsibility to coordinate and have provided by other trades where not covered by the Contractor's work scope of work all electrical wiring and power to equipment, controls and devices, all plumbing and any other work from other trades as required to provide fully functional HVAC systems per contract documents.
- E. Discrepancies: Any error, conflict or discrepancy in Drawings, Specifications and/or existing conditions shall be reported immediately. Do not proceed with any questionable items of work until clarification of same has been made. Should rearrangement or re-routing of piping or ductwork be necessary, provide for approval the simplest layout possible for that particular portion of the work. Under no circumstances shall beams, girders, footings or columns be cut for mechanical items. Casting of pipes into concrete is prohibited unless so shown on Drawings.
- F. The Contractor shall cooperate with others to avoid interferences and delays in the construction work.
- G. Interference as a result of poor coordination or lack of cooperation with other trades shall be corrected at the Contractor's expense.

**3.2. CUTTING AND PATCHING**

- A. General: Perform cutting and patching in accordance with Division 1.
- B. Protection: During cutting and patching, protect adjacent installations. Provide temporary barriers to prevent the spread of dust and dirt outside of the immediate work area.
- C. Repair: Patch finished surfaces and building components using new materials to match the existing.
- D. Inspection: Upon written direction from the Architect, uncover and restore work to provide for observation of concealed work.



**BASIC HVAC REQUIREMENTS****3.3. MECHANICAL EQUIPMENT WIRING**

- A. Provide all motor starters, control devices, and wiring complete from power source indicated on Drawings.
- B. Equipment and systems shown on the Drawings and/or specifications, 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 controls for the actual selected equipment/system.

**3.4. INSTALLATION**

- A. Manufacturer's directions shall be followed in cases where the manufacturers of materials and equipment used in this contract furnish directions covering points not shown in the drawings and specifications.
- B. Locating and Positioning Equipment: Observe all Codes and Regulations and good common practice in locating and installing mechanical equipment and material so that completed installation presents the least possible hazard. Maintain recommended clearances for repair and service to all equipment.
- 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. Where mounting heights or locations are not identified, install systems, equipment and materials to provide maximum headroom.
- E. Provide clearance for installation of insulation and access to valves, fittings, damper actuators, etc. on pipe and duct systems.
- F. Install systems, materials and equipment giving right of way to systems required to be installed at a specific slope or operation by gravity.
- G. Provide condensate drain piping to over nearest floor drain for all coils, furnaces, boilers, domestic water heaters and the likes.
- H. Provide all sheaves required for final air balance. Contractor shall not make assumptions or exceptions concerning the number of sheave replacements or adjustments necessary to meet the design requirements. Balance all HVAC systems to provide the amount of air indicated at each diffuser, grille or register.
- I. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and the fan has been test run under observation. Fans shall not be used during construction unless specifically authorized by the Owner and reviewed by the Engineer.
- J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.
- K. Installation shall be in accordance with the requirements of the equipment manufacturer, including special requirements for seismic restraints.
- L. Equipment Manufacturer's Responsibility and Services:
  - 1. A manufacturer's representative for major equipment and operating systems shall be provided as necessary to assist the Contractor during installation, and to provide written certification that the equipment has been installed as specified and in accordance with the manufacturer's representative.

**BASIC HVAC REQUIREMENTS**

2. The manufacturer's representative shall provide the initial startup of equipment in the presence of the Owner.
  - a. Provide a pre-start check of all piping, valves, control devices, control panels, and equipment.
  - b. Calibrate and adjust equipment and controls for operation at the specified design and conditions.
  - c. Provide a record of all startup events noting problems and their resolution.
  - d. Provide a record of all set points for operational controls and devices.
3. Upon the completion of the equipment startup, provide instructional time with the Owner's personnel to review the operations and maintenance manuals and perform each step necessary for startup, shutdown, troubleshooting, and routine maintenance. The instructional time shall be scheduled through the Owner.
4. Upon completion of the inspections, startup, testing, and checkout procedures, the equipment manufacturer shall submit written notice to the Owner that the units are ready for use by the Owner. Provide a certificate of calibration for all equipment.

**3.5. MOUNTING AND SHIMMING**

- A. Mount equipment as shown on the Drawings. Provisions for mounting special equipment on spring isolators, snubbers, and inertia bases are specified in Section 23 05 48, Vibration Isolation and Sound and Seismic Controls for HVAC Piping and Equipment.
- B. Level the equipment by means of 304 stainless steel wedges (stainless steel plates and stainless steel shims). Wedge taper shall not be greater than 1/4 inch per foot. Use double wedges to provide a level bearing surface for the equipment. Secure each pair of wedges in their final positions with one tack weld on each side after leveling is complete. Wedging shall be executed in a manner that will prevent a change in level or springing of the Baseplate when the anchor bolts are tightened.
  1. Adjust rotating equipment assemblies such that the driving units are properly aligned, plumb and level with the driven units and all interconnecting shafts and couplings.
  2. All rotating equipment shall be checked for proper alignment with dial indicators or laser after completion of grouting. The alignment must be within the tolerances required by the equipment manufacturer. The final alignment check shall be witnessed by the Owner.

**3.6. INSPECTION**

- A. The Contractor shall inspect his work to ensure the installation and workmanship is in accordance with these specifications and acceptable industry standards for the work being done.
- B. All materials, equipment, and workmanship shall be subject to inspection at any time by the Owner. Contractor shall correct any work, materials, or equipment not in accordance with the Contract Documents.
- C. Any work enclosed or covered up prior to inspection and testing shall be uncovered. After the work has been tested, inspected and accepted, repair as necessary to return disturbed work to its original and proper condition at no cost to the Owner.

**BASIC HVAC REQUIREMENTS****3.7. SAFETY CONSIDERATIONS**

- A. All equipment shall be installed with suitable access clearances that satisfy OSHA and code requirements for maintenance or removal of replaceable parts and components, and with necessary unions or flanges to perform the maintenance or removal without removing the connecting appurtenances.
- B. Where equipment requiring periodic maintenance cannot be reached by normal walkways because of interference with ductwork, piping, or other obstructions the Contractor shall notify the Owner and propose an alternate safe means of access. These may include construction of an overhead platform with stairway or ladder ends and safety railings or handholds, or walk-through duct plenums with hinged access doors, or as required to meet OSHA standards for safe maintenance procedures.

**3.8. CLEANING, START-UP, AND ADJUSTING**

- A. The Contractors shall be responsible for proper operation of all systems, minor subsystems, and services provided under this section. He shall coordinate start-up procedures, calibration, and system checkout with all project managers. Any system operational problems shall be diagnosed; all correctional procedures shall be initiated as required to bring out the system into compliance with the design, and the problem then shall be rechecked to verify that the system operates normally.
- B. Thoroughly clean all parts of the installation at the completion of the work. The Contractor shall clean up and remove from the premises all refuse material, crates, and rubbish arising from his work. Remove, clean, and reinstall all filters. Belt-drive tensions and alignments shall be checked. All motors and bearings shall be lubricated in accordance with the manufacturer's service manuals prior to equipment start-up. Provide a lubrication schedule for every item of equipment furnished under this section. The schedule shall include the type of lubricant and the application frequency.

**END OF SECTION**

**VIBRATION ISOLATION AND SOUND AND SEISMIC CONTROLS  
FOR HVAC PIPING AND EQUIPMENT**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Vibration-isolated equipment support bases.
- B. Vibration isolators.
- C. External seismic snubber assemblies.
- D. Seismic restraint systems.
- E. Vibration-isolated and/or seismically engineered roof curbs.

**1.2. RELATED REQUIREMENTS**

- A. Section 22 15 00 - General Service Compressed Air System.
- B. Section 23 05 49 - HVAC Seismic Restraint.

**1.3. REFERENCE STANDARDS**

- A. ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016.
- B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.
- C. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment; 2002.
- D. FEMA 414 - Installing Seismic Restraints for Duct and Pipe; 2004.
- E. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage; 2012.
- F. MFMA-4 - Metal Framing Standards Publication; 2004.
- G. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data:
  - 1. Provide manufacturer's product literature documenting compliance with PART 2 PRODUCTS.
  - 2. Include seismic rating documentation for each isolator and restraint component accounting for horizontal, vertical, and combined loads.
- C. Shop Drawings:
  - 1. Provide schedule of vibration isolator type with location and load on each.
  - 2. Include selections from prescriptive design tables that indicate compliance with the applicable building code and the vibration isolator manufacturer's requirements.
  - 3. Clearly indicate the load and capacity assumptions selected. Include copies of any calculations.
  - 4. Include the calculations that indicate compliance with the applicable building code for seismic controls and the vibration isolator manufacturer's requirements.
  - 5. Include the seal of the Professional Structural Engineer registered in the State of Oregon in which the Project is located, on drawings and calculations which at a minimum include the following:

**VIBRATION ISOLATION AND SOUND AND SEISMIC CONTROLS  
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- a. Seismic Restraint Details: Detailed drawings of seismic restraints and snubbers including anchorage details that indicate quantity, diameter, and depth of penetration, edge distance, and spacing of anchors.
  - b. Equipment Seismic Qualification Certification: Certification by the manufacturer or responsible party that each piece of equipment provided will withstand seismic force levels as specified in the applicable building code for seismic controls.
    - 1. Basis for Certification: Indicate whether the withstand certification is based on actual testing of assembled components, on calculations, or on historic data.
    - 2. Indicate equipment to be sufficiently durable to resist design forces and or remain functional after the seismic event.
  - c. Dimensioned outline drawings of equipment identifying center of gravity, locations, and provisions for mounting and anchorage.
  - d. Detailed description of the equipment anchorage devices on which the certifications are based.
  - e. Statement of Special Inspections: Prepared by the registered design professional in responsible charge.
- D. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

**1.5. QUALITY ASSURANCE**

- A. Comply with applicable building code.
- B. Perform design and installation in accordance with applicable codes.
- C. Designer Qualifications: Perform design under direct supervision of a Professional Structural Engineer experienced in design of this type of work and registered and licensed in Oregon.
- D. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
  - 1. Member of Vibration Isolation and Seismic Control Manufacturers Association (VISCMA).
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of documented experience.
- F. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

**PART 2 PRODUCTS****2.1. MANUFACTURERS**

- A. Kinetics Noise Control, Inc.: [www.kineticsnoise.com](http://www.kineticsnoise.com).
- B. Mason Industries: [www.mason-ind.com](http://www.mason-ind.com).
- C. M.W. Saussé & Co., Inc.; [www.vibrex.net](http://www.vibrex.net).

**VIBRATION ISOLATION AND SOUND AND SEISMIC CONTROLS  
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- D. Amber/Booth Company: [www.amberbooth.com](http://www.amberbooth.com).
- E. Substitutions: See Section 01 60 00 - Product Requirements.

**2.2. PERFORMANCE REQUIREMENTS**

- A. General:
  - 1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
  - 2. Steel springs to function without undue stress or overloading.
  - 3. Steel springs to operate in the linear portion of the load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
  - 4. Lateral to vertical stiffness ratio to not exceed 0.08 with spring deflection at minimum 75 percent of specified deflection.
- B. Provide vibration isolation on motor driven equipment over 2.0 hp, plus connected piping and ductwork.
- C. Provide minimum static deflection of isolators for equipment as follows:
  - 1. Upper Floors, Normal
    - a. 400 - 600 rpm: 3.5 inch
    - b. 600 - 800 rpm: 2 inch
    - c. 800 - 900 rpm: 1 inch
    - d. 1100 - 1500 rpm: 0.5 inch
    - e. Over 1500 rpm: 0.2 inch

**2.3. VIBRATION ISOLATORS**

- A. General Requirements:
  - 1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
- B. Non-Seismic Type:
  - 1. All Elastomeric-Fiber Glass Pads:
    - a. Configuration: Flat or molded.
    - b. Thickness: 0.25 inch minimum.
    - c. Assembly: Single or multiple layers using bonded, galvanized sheet metal separation plate between each layer with load plate providing evenly distributed load over pad surface.
  - 2. Elastomeric Mounts:
    - a. Material: Oil, ozone, and oxidant resistant compounds.
    - b. Assembly: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.
  - 3. Steel Springs:
    - a. Assembly: Freestanding, laterally stable without housing.
    - b. Leveling Device: Rigidly connected to equipment or frame.
  - 4. Restrained Steel Springs:
    - a. Housing: Rigid blocking during rigging prevents equipment installed and operating height from changing during temporary weight reduction.

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FOR HVAC PIPING AND EQUIPMENT**

- b. Equipment Wind Loading: Adequate means for fastening isolator top to equipment and isolator base plate to supporting structure.
  - 5. Elastomeric Hangers:
    - a. Housing: Steel construction containing elastomeric isolation element to prevent rod contact with housing and short-circuiting of isolating function.
    - b. Furnish steel load distribution plate sandwiching elastomeric element to housing.
  - 6. Spring Hanger:
    - a. Housing: Steel construction containing stable steel spring and integral elastomeric element preventing metal to metal contact.
    - b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.
  - 7. Combination Elastomeric-Spring Hanger:
    - a. Housing: Steel construction containing stable steel spring with elastomeric element in series isolating upper connection of hanger box to building structure.
    - b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.
  - 8. Thrust Restraints:
    - a. Housing: Steel construction containing stable steel spring and integral elastomeric element installed in pairs to resist air pressure thrusts.
    - b. Bottom Openings: Sized to allow plus/minus 15 degrees rod misalignment.
- C. Seismic Type:
  - 1. Coil Springs Consisting of Multiple Elements:
    - a. Housing: Manufactured from cast iron, cast aluminum, or steel material.
    - b. Ductile Material: Designed and rated for seismic applications.
    - c. Spring: Restrained by housing without significant degradation of vibration isolation capabilities during normal equipment operating conditions.
    - d. Resilient Snubbing Grommet System: Incorporated and designed with clearances of no more than 0.25 inch in any direction preventing direct metal-to-metal contact between supported member and fixed restraint housing.
    - e. Resilient Pad: Located in series with spring.
    - f. Coil Springs: Color coded elements to have a lateral stiffness greater than 0.8 times the rated vertical stiffness with 50 percent overload capacity.
    - g. Finish: Suitable for the application.
  - 2. All Directional Elastomeric:
    - a. Material: Molded from oil, ozone, and oxidant resistant compounds.
    - b. Operating Parameters: Designed to operate within the isolator strain limits providing maximum performance and service life.
    - c. Attachment Method: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.
    - d. Rating: Cast iron and aluminum housings rated for seismic restraint applications.



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- e. Minimum Operating Static Deflections: Deflections indicated in project documents are not to exceed published load capacities.

**2.4. EXTERNAL SEISMIC SNUBBER ASSEMBLIES**

- A. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.
- B. Seismic Snubbing Elements:
  - 1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
  - 2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.
- C. Comply with:
  - 1. ASHRAE Handbook - HVAC Applications
  - 2. FEMA 412
  - 3. FEMA 413
  - 4. FEMA 414
  - 5. FEMA E-74
  - 6. SMACNA - Seismic Duct Restraint Manual
- D. All Directional External:
  - 1. Application: Minimum three (3) snubbers are required for each equipment installation, oriented properly to restrain isolated equipment in all directions.
  - 2. Construction: Interlocking steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
  - 3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
  - 4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.
- E. Lateral External:
  - 1. Application: Minimum three (3) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions where uplift forces are zero or addressed by other restraints.
  - 2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
  - 3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
  - 4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.
- F. Omni Directional External:



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1. Application: Minimum four (4) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions.
  2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
  3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
  4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.
- G. Horizontal Single Axis External:
1. Application: Minimum four (4) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions where uplift forces are zero or addressed by other restraints.
  2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
  3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
  4. Resilient Pad: Minimum 0.25 inch thick cushions any impact and prevents metal-to-metal contact.

**2.5. SEISMIC RESTRAINT SYSTEMS**

- A. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.
- B. Cable Restraints:
1. Comply with ASCE 19.
  2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
  3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
  4. Use protective thimbles for cable loops where potential for cable damage exists.
- C. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.
- D. Comply with:
1. ASHRAE Handbook - HVAC Applications
  2. FEMA 412
  3. FEMA 413
  4. FEMA 414
  5. FEMA E-74
  6. SMACNA - Seismic Duct Restraint Manual
- E. Cable Restraints:
1. Wire Rope: Steel wire strand cables sized to resist seismic loads in all lateral directions.

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2. Protective Thimbles: Eliminates potential for dynamic cable wear and strand breakage.
  3. Size: Based on the lesser of cable capacity or anchor load taking into account bracket geometry.
  4. Connections:
    - a. Use overlapping wire rope U clips, cable clamping bolts, swaged sleeves or seismically rated tool-less wedge insert lock connectors.
    - b. Internally brace clevis hanger bracket cross bolt to prevent deformation.
  5. Vertical Suspension Rods: Attach required bracing of sufficient strength to prevent rod buckling from vertical compression forces utilizing series of attachment clips.
- F. Rigid Restraints:
1. Structural Element: Sized to resist seismic loads in all lateral directions and carry both compressive and tensile loading.
  2. Size: Based on the lesser of cable capacity or anchor load taking into account bracket geometry.
  3. Connections: Internally brace clevis hanger bracket cross bolt to prevent deformation.
  4. Static Support System: Anchorage capable of carrying additional tension loads generated by the vertical component of the rigid brace compression which is additive to any static load requirements on the system.
  5. Vertical Suspension Rods: Attached required bracing of sufficient strength to prevent rod buckling from vertical compression forces utilizing series of attachment clips.

**2.6. VIBRATION-ISOLATED AND/OR SEISMICALLY ENGINEERED ROOF CURBS**

- A. Vibration Isolation Curbs:
1. Nonseismic Curb Rail:
    - a. Location: Between existing roof curb and rooftop equipment.
    - b. Construction: Aluminum or steel.
    - c. Integral vibration isolation to comply with requirements of this section.
    - d. Weather exposed components consist of corrosion resistant materials.
  2. Nonseismic Curb:
    - a. Location: Between structure and rooftop equipment.
    - b. Construction: Aluminum or steel.
    - c. Integral vibration isolation to comply with requirements of this section.
    - d. Weather exposed components consist of corrosion resistant materials.
- B. Seismic Type:
1. Non-isolated Curb and Fabricated Equipment Piers:
    - a. Location: Between structure and rooftop equipment.
    - b. Construction: Steel.
    - c. Weather exposed components consist of corrosion resistant materials.
  2. Vibration Isolation Curb:

**VIBRATION ISOLATION AND SOUND AND SEISMIC CONTROLS  
FOR HVAC PIPING AND EQUIPMENT**

- a. Location: Between structure and rooftop equipment.
- b. Construction: Steel.
- c. Integral vibration isolation to conform to requirements of this section.
- d. Snubbers consist of minimum 0.25 inch thick resilient pads to avoid metal-to-metal contact without compromising vibration isolating capabilities.
- e. Weather exposed components consist of corrosion resistant materials.

**PART 3 EXECUTION****3.1. INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Secure fasteners according to manufacturer's recommended torque settings.
- D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

**3.2. INSTALLATION - GENERAL**

- A. Install in accordance with manufacturer's instructions.
- B. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- C. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- D. Support piping connections to equipment mounted on isolators using isolators or resilient hangers as follows:
  - 1. Up to 4 Inches Pipe Size: First three points of support.

**3.3. INSTALLATION - SEISMIC**

- A. Refer to Section 23 0549.

**3.4. FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect vibration isolation and/or seismic control components for damage and defects.
- C. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.
- D. Inspect isolated equipment after installation and submit report. Include static deflections.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Seismic restraint of equipment, piping and ductwork.

**1.2. RELATED SECTIONS**

- A. Section 23 00 00 - Basic HVAC Requirements.
- B. Section 23 05 48 - Vibration Isolation and Sound and Seismic Controls for HVAC Piping and Equipment.
- C. Section 23 31 00 - HVAC Ducts and Casings.
- D. Section 23 36 00 - Air Terminal Units.
- E. Section 23 73 13 - Modular Indoor Central-Station Air-Handling Units.
- F. Section 23 74 13 - Packaged Outdoor Central-Station Air-Handling Units.
- G. Section 23 81 27 - Split-System Heating and Cooling.

**1.3. QUALITY ASSURANCE**

- A. Seismic Restraints:
  - 1. The Anchorage and/or seismic restraint of permanent equipment and associated systems listed below shall be designed to resist the total design seismic forces prescribed in the latest edition of the International Building Code.
    - a. All floor or roof-mounted equipment weighing 400 lbs. or greater.
    - b. All suspended or wall-mounted equipment weighing 20 lbs. or greater.
    - c. All vibration-isolated equipment weighing 20 lbs. or greater.
    - d. All piping 1 1/4 inches nominal diameter and larger located in boiler, mechanical equipment and refrigeration mechanical rooms.
    - e. All piping 2 1/2" inches nominal diameter and larger.
    - f. All ductwork 6 square feet and larger in cross sectional area.
    - g. All round ductwork 28 inches in diameter and larger.
    - h. Pipes, electrical conduit and ducts supported by a trapeze where none of those elements would individually require bracing, require bracing when the combined operating weight of all elements supported by the trapeze is 10 lbs/ft or greater.
- B. All calculations shall be in accordance with Chapter 16 of the latest edition of the International Building Code.

**1.4. SUBMITTALS**

- A. Submit the following in accordance with Section 01 30 00:
  - 1. All anchorage and seismic restraints shall be designed and stamped by a professional engineer licensed in the state of the project location. Design shall include:
    - a. Number, size and location of anchors for floor or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both the

- unit to the curb and the curb to the structure. In addition, provide calculations or test data verifying the curb can accept the seismic loads.
- b. Number, size and location of seismic restraint devices and anchors for vibration-isolated and suspended equipment. Provide calculations or test data verifying the horizontal and vertical ratings of the seismic restraint devices.
  - c. Number, size and location of braces and anchors for suspended piping and ductwork on shop drawings. In addition:
    - 1. The contractor must select a single seismic restraint system pre-designed to meet the requirements of the latest edition of the International Building Code such as the 2011 Mason Industries Seismic Restraint Guidelines for Suspended Piping, Ductwork, Electrical Systems and floor and roof mounted equipment.
    - 2. Details or designs from separate seismic restraint guidelines are not acceptable. Installations not addressed by the selected system must be designed, detailed and submitted along with the shop drawings.
    - 3. Maximum seismic loads shall be indicated on drawings at each brace location. Drawings shall bear the stamp and signature of the registered professional engineer licensed in the state of the project location who designed the layout of the braces.

## **PART 2 PRODUCTS**

### **2.1. MANUFACTURERS**

- A. Amber Booth.
- B. Mason Industries, Inc.
- C. Kinetics Corporation.
- D. Vibrex.
- E. Substitutions: Under provisions of Section 01 60 00.

### **2.2. SEISMIC RESTRAINTS**

- A. General Requirements:
  - 1. Seismic restraints shall be provided for all equipment, both supported and suspended, piping and ductwork as listed above.
  - 2. Bracing of piping and ductwork shall be in accordance with provisions set forth in SMACNA seismic restraint manual.
  - 3. Structural requirements for restraints, including their attachment to building structure, shall be reviewed and approved by the structural engineer.
  - 4. Attachments to supported or suspended equipment must be coordinated with the equipment manufacturer.
- B. Supported Equipment Products:
  - 1. Seismic restraints shall consist of interlocking steel members restrained by shock absorbent neoprene materials compounded to bridge bearing specifications as

**HVAC SEISMIC RESTRAINT**

previously noted in paragraph 1.3. Elastomeric materials shall be replaceable and be a minimum 3/4-inch thick. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8-inch, nor more than 1/4-inch. Type 1 - Seismic Snubbers: All-directional seismic snubbers shall consist of interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene. Bushing shall be replaceable and a minimum of 1/4 inch thick. A minimum air gap of 1/8 inch shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces. Snubber end caps shall be removable to allow inspection of internal clearances. The snubber shall be designed to accept horizontal and vertical seismic loads as defined in Section 1.03.B. Mason Type Z-1225 or Z-1011.

2. Each snubber shall be capable of restraint in all three mutually orthogonal directions. Type 2 - Seismic Sway Braces - Seismic sway braces shall consist of galvanized steel aircraft cables or steel angles/channels. Cables braces shall be designed to resist seismic tension loads and steel braces shall be designed to resist both tension and compression loads with a minimum safety factor of 2. Brace end connections shall be steel assemblies that swivel to the final installation angle. Do not mix cable and steel braces to brace the same system or equipment. Steel angles, when required, shall be clamped to the threaded hanger rods at the seismic sway brace locations utilizing a minimum of two ductile iron clamps. Sway braces shall be designed to accept horizontal and vertical seismic loads as defined in Section 1.03.B. Mason Type SCB, SSB, SRC and UC.
3. Submittals shall include load versus deflection curves up to 1/2-inch on the x, y and z planes.
4. Mason Model Z-1011

C. Bracing of Pipes:

1. Provide seismic bracing of all piping as detailed below. (Exception: Piping suspended by individual hangers 12 inches or less in length, as measured from the top of the pipe to the bottom of the support where the hanger is attached, need not be braced).
  - a. Brace all gas piping.
  - b. Brace all piping located in boiler rooms, mechanical equipment rooms, and refrigeration mechanical rooms that is 1-1/4-inch nominal diameter and larger.
  - c. Brace all pipes 2-1/2-inch nominal diameter and larger.
2. For all gas piping, as specified in 1(a) the bracing details, schedules, and notes may be used, except that transverse bracing shall be at 20 feet maximum, and longitudinal bracing shall be at 40 feet maximum.
3. Seismic braces for pipes on trapeze hangers may be used.
4. Provide flexibility in joints where pipes pass through building seismic joints or expansion joints or where rigidly supported pipes connect to equipment with vibration isolators. For threaded piping, the flexibility may be provided by the installation of swing joints.

**HVAC SEISMIC RESTRAINT**

5. Cast iron pipe of all types, glass pipe, and any other pipe jointed with a shield and clamp assembly, where the top of the pipe is 12 inches or more from the supporting structure, shall be braced on each side of a change in direction of 90 degrees or more. Riser joints shall be braced or stabilized between floors.
  6. Vertical risers shall be laterally supported with a riser clamp at each floor. For buildings greater than six stories high, all risers shall be engineered individually.
- D. Bracing of Ductwork:
1. Brace rectangular ducts with cross sectional areas of 6 square feet and larger. Brace flat oval ducts in the same manner as rectangular ducts. Brace round ducts with diameters of 28 inches and larger. Brace flat oval ducts the same as rectangular ducts of the same nominal size (Exception: No bracing is required if the duct is suspended by hangers 12 inches or less in length, as measured from the top of the duct to the bottom of the support where the hanger is attached).
  2. Transverse bracing shall occur at the interval specified in the SMACNA tables or at both ends if the duct run is less than the specified interval. Transverse bracing shall be installed at each duct turn and at each end of a duct run, with a minimum of one brace at each end.
  3. Longitudinal bracing shall occur at the interval specified in the SMACNA tables with at least one brace per duct run. Transverse bracing for one duct section may also act as longitudinal bracing for a duct section connected perpendicular to it if the bracing is installed within four feet of the intersection of the ducts and if the bracing is sized for the larger duct. Duct joints shall conform to SMACNA duct construction standards.
- E. Suspended Equipment and Piping and Ductwork:
1. Cable Method: The seismic restraint shall consist of a combination of stranded steel aircraft cable and the specified vibration isolation hanger with an added nut and neoprene and steel washer. The cable resists lateral and downward motion. The modified vibration hanger resists upward motion.
  2. Cable attachment details, cable size, and the neoprene and steel washers shall be sized by the manufacturer and are to be indicated in the Shop Drawings.
  3. Provide detailed Shop Drawings for approval in sufficient time to allow structural attachment work to be incorporated into the normal work sequence.

**PART 3 EXECUTION****3.1. SEISMIC RESTRAINTS****A. General:**

1. Install and adjust seismic restraints so that the equipment, piping, and ductwork supports are not degraded by the restraints.
2. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise.

**B. Supported Equipment:**



**HVAC SEISMIC RESTRAINT**

1. Each vibration isolation frame for supported equipment shall have a minimum of four seismic snubbers mounted as close as possible to the vibration isolators and/or the frame extremities.
  2. Care must be taken so that a minimum 1/8-inch air gap in the seismic restraint snubber is preserved on all sides in order that the vibration isolation potential of the isolator is not compromised. This requires that the final snubber adjustment be completed after the vibration isolators are properly installed and the installation approved.
- C. Bracing of Pipes:
1. Branch lines may not be used to brace main lines.
  2. Transverse bracing shall be at 40 feet maximum except where a lesser spacing is indicated in the SMACNA tables for bracing of pipes.
  3. Longitudinal bracing shall be at 80 feet maximum except where a lesser spacing is indicated in the tables. In pipes where thermal expansion is a consideration, an anchor point may be used as the specified longitudinal brace provided that it has a capacity equal to or greater than a longitudinal brace. The longitudinal braces and connections must be capable of resisting the additional force induced by expansion and contraction.
  4. A rigid piping system shall not be braced to dissimilar parts of the building or to two dissimilar building systems that may respond differently during an earthquake.
  5. Transverse bracing for one pipe section may also act as longitudinal bracing for a pipe section of the same size connected perpendicular to it if the bracing is installed within 24 inches of the elbow or tee.
- D. Bracing of Ductwork:
1. Hangers must be positively attached to the duct within 2 inches of the top of the duct with a minimum of two #10 sheet metal screws.
  2. Group of ducts may be combined in larger frame so that the combined weights and dimensions of the ducts are less than or equal to the maximum weight and dimensions of the duct for which bracing details are selected.
  3. Walls, including gypsum board nonbearing partitions, which have ducts running through them, may replace a typical transverse brace. Provide solid blocking around duct penetrations at stud wall construction.
  4. Unbraced ducts shall be installed with a 6-inch minimum clearance to vertical ceiling hanger wires.
- E. Suspended Equipment, Piping, and Ductwork Cable Method:
1. Cables shall be adjusted to a degree of slackness approved by the Structural Engineer.
  2. Uplift and downward restraint nuts and washers for the Type HST hangers shall be adjusted so that there is a minimum 1/4-inch clearance.

**END OF SECTION**



**IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Nameplates.
- B. Tags.
- C. Labels.
- D. Lockout devices.

**1.2. RELATED REQUIREMENTS**

- A. Section 09 91 23 - Interior Painting: Identification painting.

**1.3. REFERENCE STANDARDS**

- A. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Product Data: Provide manufacturers catalog literature for each product required.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- E. Project Record Documents: Record actual locations of tagged valves.

**PART 2 PRODUCTS****2.1. MANUFACTURERS**

- A. Brady Corporation: [www.bradycorp.com](http://www.bradycorp.com).
- B. Safety Sign Company: [www.safetysignco.com](http://www.safetysignco.com).
- C. Seton Identification Products: [www.seton.com/aec](http://www.seton.com/aec).
- D. Substitutions: See Section 01 60 00 - Product Requirements.

**2.2. NAMEPLATES**

- A. Description: Laminated three-layer plastic with engraved letters.
  - 1. Letter Color: Black.
  - 2. Letter Height: 1/2 inch.
  - 3. Background Color: Yellow.
  - 4. Plastic: Comply with ASTM D709.

**2.3. TAGS**

- A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

**IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

**2.4. LABELS**

- A. Description: Aluminum, size 1.9 x 0.75 inches, adhesive backed with printed identification.

**2.5. LOCKOUT DEVICES**

- A. Lockout Hasps:
  - 1. Manufacturers:
    - a. Anodized aluminum or Reinforced nylon hasp with erasable label surface; size minimum 7-1/4 x 3 inches.
- B. Valve Lockout Devices:
  - 1. Steel device preventing access to valve operator, accepting lock shackle.

**PART 3 EXECUTION****3.1. PREPARATION**

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 09 91 23 for stencil painting.

**3.2. INSTALLATION**

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Identify air handling units, pumps with 8 x 4 inch plastic nameplates. Small devices may be identified with tags.
- F. Identify control panels and major control components outside panels with plastic nameplates.
- G. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Manual motor controllers.
- B. Magnetic motor controllers.
- C. Combination magnetic motor controllers and disconnects.

**1.2. RELATED REQUIREMENTS**

- A. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- C. Section 26 28 13 - Fuses.

**1.3. REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association; 2000 (R2005).
- C. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; National Electrical Manufacturers Association; 2000 (R2010).
- D. NEMA ICS 6 - Industrial Control and Systems: Enclosures; National Electrical Manufacturers Association; 1993 (R2006).
- E. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).
- F. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.
- G. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
- C. Test Reports: Indicate field test and inspection procedures and test results.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Maintenance Data: Replacement parts list for controllers.

**1.5. QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

**PART 2 PRODUCTS**

**2.1. MANUFACTURERS**

- A. Eaton Corporation; Cutler-Hammer Product: [www.eaton.com](http://www.eaton.com).
- B. General Electric Company: [www.geindustrial.com](http://www.geindustrial.com).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us).
- D. Allen Bradley: [www.ab.com](http://www.ab.com).
- E. Substitutions: See Section 01 60 00 - Product Requirements.

**2.2. MANUAL CONTROLLERS**

- A. Manual Motor Controllers: NEMA ICS 2, AC general-purpose, Class A, manually operated, full-voltage controller with overload element, red pilot light, field reversible auxiliary contact, and push button operator.
- B. Fractional Horsepower Manual Controllers: NEMA ICS 2, AC general-purpose, Class A, manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light, and push button operator.
- C. Motor Starting Switches: NEMA ICS 2, AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, without thermal overload unit, with red pilot light and key operator.
- D. Enclosures: NEMA ICS 6, Type as required to meet conditions of installation.

**2.3. AUTOMATIC CONTROLLERS**

- A. Magnetic Motor Controllers: NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower.
- B. Coil Operating Voltage: 120 volts, 60 Hertz.
- C. Overload Relays: NEMA ICS 2; bimetal.
- D. Enclosures: NEMA ICS 6, Type as required to meet conditions of installation.
- E. For starters above 10 HP at 230 volts or 20 HP at 460 volts, provide soft-start with horsepower rated speed bypass contactor, keypad, and LCD to display starter set-up/status/diagnostics and constant current and current ramp modes.

**HVAC ENCLOSED MOTOR CONTROLLERS****2.4. ACCESSORIES**

- A. Auxiliary Contacts: NEMA ICS 2, 2 field convertible contacts in addition to seal-in contact.
- B. Cover Mounted Pilot Devices: NEMA ICS 5, heavy duty oiltight type.
- C. Pilot Device Contacts: NEMA ICS 5, Form Z, rated A150.
- D. Pushbuttons: Recessed and lockable type.
- E. Indicating Lights: Transformer, LED type.
- F. Selector Switches: Rotary type, HOA. Provided on all automatic controllers.
- G. Relays: NEMA ICS 2.
- H. Control Power Transformers: 120 volt secondary. Provide fused primary, secondary, and bond unfused leg of secondary to enclosure.
- I. Solid-state leg loss protection for 3 phase motors.

**2.5. DISCONNECTS (AS APPLICABLE)**

- A. Combination Controllers: Combine motor controllers with disconnects in common enclosure. Obtain IEC Class 2 coordinated component protection.
- B. Thermal Magnetic Circuit Breakers: Integral thermal and instantaneous magnetic trip in each pole; UL listed.
- C. Motor Circuit Protector: Circuit breakers with integral instantaneous magnetic trip in each pole; UL listed.
- D. Nonfusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle.
- E. Fusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate Class R fuses.

**PART 3 EXECUTION****3.1. INSTALLATION**

- A. Install enclosed controllers where indicated, in accordance with manufacturer's instructions.
- B. Install securely, in a neat and workmanlike manner, as specified in NECA 1.
- C. Provide supports in accordance with Section 26 05 29.
- D. Height: 5 ft to operating handle.
- E. Provide fuses for fusible switches; refer to Section 26 28 13 for product requirements.
- F. Select and install overload heater elements in motor controllers to match installed motor characteristics.
- G. Identify enclosed controllers in accordance with Section 26 05 53.
- H. All single-phase motors shall have manual or automatic controllers as required by control sequence.
- I. All three phase motors shall have automatic controllers.
- J. All controllers shall be provided with enclosure.

**3.2. FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with Section 01 40 00.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.16.1.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Variable frequency controllers.

**1.2. REFERENCE STANDARDS**

- A. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems; National Electrical Manufacturers Association; 2013.
- B. NEMA ICS 7 - Industrial Control and Systems: Adjustable-Speed Drives; National Electrical Manufacturers Association 2006.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association 2003.
- D. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007.
- E. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

**1.3. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
- C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.
- D. Test Reports: Indicate field test and inspection procedures and test results.
- E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Manufacturer's Field Reports: Indicate start-up inspection findings.
- G. Operation Data: NEMA ICS 7.1. Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.
- H. Maintenance Data: NEMA ICS 7.1. Include routine preventive maintenance schedule.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Air Filters: Two of each type.

**1.4. QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

**1.5. DELIVERY, STORAGE, AND HANDLING**

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

**PART 2 PRODUCTS**

**2.1. MANUFACTURERS**

- A. ABB: [www.abb.us](http://www.abb.us).
- B. Danfoss: [www.danfoss.com](http://www.danfoss.com).
- C. Yaskawa: [www.yaskawa.com](http://www.yaskawa.com)
- D. Substitutions: See Section 01 60 00 - Product Requirements.

**2.2. DESCRIPTION**

- A. Variable Frequency Controllers: Enclosed controllers suitable for operating the indicated loads, in conformance with requirements of NEMA ICS 7. Select unspecified features and options in accordance with NEMA ICS 3.1.
  - 1. Employ microprocessor-based inverter logic isolated from power circuits.
  - 2. Employ pulse-width-modulated inverter system.
  - 3. Design for ability to operate controller with motor disconnected from output.
  - 4. Design to attempt five automatic restarts following fault condition before locking out and requiring manual restart.
- B. Enclosures: NEMA 250, Type 1, suitable for equipment application in places restricted to persons employed on the premises.
- C. The variable frequency drive shall be RoHS compliant. Circuit boards shall be lead free. No electrolytic capacitors allowed.
- D. Finish: Manufacturer's standard enamel.

**2.3. OPERATING REQUIREMENTS**

- A. Rated Input Voltage: Refer to Electrical drawings.
- B. Motor Nameplate Voltage: Refer to Electrical drawings.
- C. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.
- D. Operating Ambient: 0 degrees C to 40 degrees C.
- E. Minimum Efficiency at Full Load: 97 percent.
- F. Volts Per Hertz Adjustment: Plus or minus 10 percent.



**HVAC VARIABLE FREQUENCY CONTROLLERS**

- G. Current Limit Adjustment: 60 to 110 percent of rated.
- H. Acceleration Rate Adjustment: 0.5 to 30 seconds.
- I. Deceleration Rate Adjustment: 1 to 30 seconds.
- J. Input Signal: 4 to 20 mA DC and 0 to 10 mV DC.

**2.4. COMPONENTS**

- A. Display: Provide integral digital display to indicate output voltage, output frequency, output current, motor speed, total kWh consumed, kWh trip and run counters and total hours run.
  - 1. Filters: the VFD shall be provided with built-in RFI filters and all models 3 HP or more shall include a DC Choke.
  - 2. Communication: the VFD shall have the capability of communicating with over the following protocols:
    - a. BACnet/MSTP and BACnet/IP
    - b. LONBus
    - c. Modbus RTU and Modbus/TCP
    - d. N2
  - 3. Memory: the control panel shall have EEPROM to retain all parameters when the VFD is powered down.
- B. Status Indicators: Separate indicators for overcurrent, overvoltage, ground fault, overtemperature, and input power ON.
- C. Furnish HAND-OFF-AUTOMATIC selector switch and manual speed control. HOA features built into the keypad are acceptable.
- D. Include undervoltage release.
- E. Control Power Source: Separate circuit.
- F. Door Interlocks: Furnish mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified persons.
- G. Safety Interlocks: Furnish terminals for remote contact to inhibit starting under both manual and automatic mode.
- H. Control Interlocks: Furnish terminals for remote contact to allow starting in automatic mode.
- I. Manual Bypass: Not required unless noted otherwise on the drawings.
- J. Emergency Stop: Use dynamic brakes for emergency stop function.
- K. Disconnecting Means: Include integral circuit breaker with interrupt rating of 65k AIC or higher, or fused disconnect switch on the line side of each controller.
- L. Wiring Terminations: Match conductor materials and sizes indicated.

**2.5. SOURCE QUALITY CONTROL**

- A. Shop inspect and perform standard productions tests for each controller.
- B. Make completed controller available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least 7 days before inspection is allowed.
- C. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify Owner at least 7 days before inspections and tests are scheduled.

**PART 3 EXECUTION**

**3.1. EXAMINATION**

- A. Verify that surface is suitable for controller installation.
- B. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.
- C. Verify that field measurements are as indicated on shop drawings or instructed by manufacturer.

**3.2. INSTALLATION**

- A. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.
- B. Tighten accessible connections and mechanical fasteners after placing controller.
- C. Provide fuses in fusible switches; refer to Division for product requirements.
- D. Select and install overload heater elements in motor controllers to match installed motor characteristics.
- E. Provide engraved plastic nameplates; refer to Division 23 for product requirements and location.
- F. Neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place in clear plastic holder.

**3.3. FIELD QUALITY CONTROL**

- A. Provide the service of the manufacturer's field representative to prepare and start controllers.
- B. Perform field inspection and testing in accordance with Section 01 40 00.
- C. Inspect and test in accordance with NETA STD ATS, except Section 4.
- D. Perform inspections and tests listed in NETA STD ATS, Section 7.17.

**3.4. ADJUSTING**

- A. Make final adjustments to installed controller to assure proper operation of load system. Obtain performance requirements from installer of driven loads.

**3.5. CLOSEOUT ACTIVITIES**

- A. Demonstrate operation of controllers in automatic and manual modes.

**END OF SECTION**

**TESTING, ADJUSTING, AND BALANCING FOR HVAC****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Testing, adjustment, and balancing of air systems.
- B. Measurement of final operating condition of HVAC systems.
- C. Commissioning activities.

**1.2. RELATED REQUIREMENTS**

- A. Section 01 21 00 - Allowances: Inspection and testing allowances.
- B. Section 01 40 00 - Quality Requirements: Employment of testing agency and payment for services.
- C. Section 01 91 13 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

**1.3. REFERENCE STANDARDS**

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
  - 1. Submit to Architect.
  - 2. Submit to the Commissioning Authority, Construction Manager, and HVAC controls contractor.
  - 3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
  - 4. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
  - 5. Include at least the following in the plan:
    - a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
    - b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
    - c. Identification and types of measurement instruments to be used and their most recent calibration date.

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- d. Final test report forms to be used.
  - e. Detailed step-by-step procedures for TAB work for each system and issue, including:
    - 1. Terminal flow calibration (for each terminal type).
    - 2. Diffuser proportioning.
    - 3. Branch/submain proportioning.
    - 4. Total flow calculations.
    - 5. Rechecking.
    - 6. Diversity issues.
  - f. Expected problems and solutions, etc.
  - g. Criteria for using air flow straighteners or relocating flow stations and sensors; analogous explanations for the water side.
  - h. Details of how TOTAL flow will be determined; for example:
    - 1. Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
  - i. Confirmation of understanding of the outside air ventilation criteria under all conditions.
  - j. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
  - k. False loading of systems to complete TAB work, if specified.
  - l. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
  - m. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
  - n. Procedures for formal progress reports, including scope and frequency.
  - o. Procedures for formal deficiency reports, including scope, frequency and distribution.
- D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.
- E. Progress Reports.
- F. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- 1. Submit to the the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.
  - 2. Revise TAB plan to reflect actual procedures and submit as part of final report.
  - 3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
  - 4. Provide reports in PDF format complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air

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- outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
- 5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
- 6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
- 7. Units of Measure: Report data in I-P (inch-pound) units only.
- 8. Include the following on the title page of each report:
  - a. Name of Testing, Adjusting, and Balancing Agency.
  - b. Address of Testing, Adjusting, and Balancing Agency.
  - c. Telephone number of Testing, Adjusting, and Balancing Agency.
  - d. Project name.
  - e. Project location.
  - f. Project Architect.
  - g. Project Engineer.
  - h. Project Contractor.
  - i. Project altitude.
  - j. Report date.
- G. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

**PART 2 PRODUCTS - NOT USED****PART 3 EXECUTION****3.1. GENERAL REQUIREMENTS**

- A. Perform total system balance in accordance with one of the following:
  - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
  - 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- D. TAB Agency Qualifications:
  - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
  - 2. Having minimum of three years documented experience.
- E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.
- F. TAB Supervisor Qualifications: Professional Engineer licensed in Oregon.
- G. Pre-Qualified TAB Agencies:

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1. Northwest Engineering Service, Inc.
2. Air Balancing Specialty.
3. Neudorfer Engineers.
4. Precision Test and Balance, Inc.
5. Substitutions: See Section 01 60 00 - Product Requirements.

**3.2. EXAMINATION**

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
  1. Systems are started and operating in a safe and normal condition.
  2. Temperature control systems are installed complete and operable.
  3. Proper thermal overload protection is in place for electrical equipment.
  4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
  5. Duct systems are clean of debris.
  6. Fans are rotating correctly.
  7. Fire and volume dampers are in place and open.
  8. Air coil fins are cleaned and combed.
  9. Access doors are closed and duct end caps are in place.
  10. Air outlets are installed and connected.
  11. Duct system leakage is minimized.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

**3.3. PREPARATION**

- A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
  1. Require attendance by all installers whose work will be tested, adjusted, or balanced.
- B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.
- C. Provide additional balancing devices as required.

**3.4. ADJUSTMENT TOLERANCES**

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

**3.5. RECORDING AND ADJUSTING**

- A. Field Logs: Maintain written logs including:

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1. Running log of events and issues.
  2. Discrepancies, deficient or uncompleted work by others.
  3. Contract interpretation requests.
  4. Lists of completed tests.
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.
- E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.
- H. Check and adjust systems approximately six months after final acceptance and submit report.

**3.6. AIR SYSTEM PROCEDURE**

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.



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- L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.03 inches positive static pressure near the building entries.
- M. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

**3.7. COMMISSIONING**

- A. See Sections 01 91 13 - General Commissioning Requirements.
- B. Perform prerequisites prior to starting commissioning activities.
- C. Fill out Prefunctional Checklists for:
  - 1. Air side systems.
  - 2. Water side systems.
- D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.
- E. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for 25 percent of the air handlers plus a random sample equivalent to 5 percent of the final TAB report data as directed by Commissioning Authority.
  - 1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
  - 2. Use the same test instruments as used in the original TAB work.
  - 3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
  - 4. For purposes of re-check, failure is defined as follows:
    - a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
    - b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
    - c. Temperatures: Deviation of more than one degree F.
    - d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
  - 5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.
- F. In the presence of the Commissioning Authority, verify that:
  - 1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
  - 2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan



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- to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.
- G. No seasonal tests are required.
- H. No further monitoring is required.
- I. No deferred testing is required.

**3.8. SCOPE**

- A. Test, adjust, and balance the following:
1. Plumbing Pumps.
  2. Packaged Roof Top Heating/Cooling Units.
  3. Air Coils.
  4. Evaporative Humidifier.
  5. Air Handling Units.
  6. Fans.
  7. Air Filters.
  8. Air Terminal Units.
  9. Air Inlets and Outlets.
  10. Ductless Split Systems

**3.9. MINIMUM DATA TO BE REPORTED**

- A. Electric Motors:
1. Manufacturer.
  2. Model/Frame.
  3. HP/BHP.
  4. Phase, voltage, amperage; nameplate, actual, no load.
  5. RPM.
  6. Service factor.
  7. Starter size, rating, heater elements.
  8. Sheave Make/Size/Bore.
- B. V-Belt Drives:
1. Identification/location.
  2. Required driven RPM.
  3. Driven sheave, diameter and RPM.
  4. Belt, size and quantity.
  5. Motor sheave diameter and RPM.
  6. Center to center distance, maximum, minimum, and actual.
- C. Pumps:
1. Identification/number.

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2. Manufacturer.
  3. Size/model.
  4. Service.
  5. Design flow rate, pressure drop, BHP.
  6. Actual flow rate, pressure drop, BHP.
  7. Discharge pressure.
  8. Suction pressure.
  9. Total operating head pressure.
- D. Cooling Coils:
1. Identification/number.
  2. Location.
  3. Service.
  4. Manufacturer.
  5. Air flow, design and actual.
  6. Entering air DB temperature, design and actual.
  7. Entering air WB temperature, design and actual.
  8. Leaving air DB temperature, design and actual.
  9. Leaving air WB temperature, design and actual.
  10. Saturated suction temperature, design and actual.
  11. Air pressure drop, design and actual.
- E. Heating Coils:
1. Identification/number.
  2. Location.
  3. Service.
  4. Manufacturer.
  5. Air flow, design and actual.
  6. Entering air temperature, design and actual.
  7. Leaving air temperature, design and actual.
  8. Air pressure drop, design and actual.
- F. Electric Duct Heaters:
1. Manufacturer.
  2. Identification/number.
  3. Location.
  4. Model number.
  5. Design kW.
  6. Number of stages.
  7. Phase, voltage, amperage.
  8. Test voltage (each phase).
  9. Test amperage (each phase).
  10. Air flow, specified and actual.
  11. Temperature rise, specified and actual.
- G. Air Moving Equipment:
1. Location.
  2. Manufacturer.
  3. Model number.

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4. Serial number.
  5. Arrangement/Class/Discharge.
  6. Air flow, specified and actual.
  7. Return air flow, specified and actual.
  8. Outside air flow, specified and actual.
  9. Total static pressure (total external), specified and actual.
  10. Inlet pressure.
  11. Discharge pressure.
  12. Sheave Make/Size/Bore.
  13. Number of Belts/Make/Size.
  14. Fan RPM.
- H. Return Air/Outside Air:
1. Identification/location.
  2. Design air flow.
  3. Actual air flow.
  4. Design return air flow.
  5. Actual return air flow.
  6. Design outside air flow.
  7. Actual outside air flow.
  8. Return air temperature.
  9. Outside air temperature.
  10. Required mixed air temperature.
  11. Actual mixed air temperature.
  12. Design outside/return air ratio.
  13. Actual outside/return air ratio.
- I. Exhaust Fans:
1. Location.
  2. Manufacturer.
  3. Model number.
  4. Serial number.
  5. Air flow, specified and actual.
  6. Total static pressure (total external), specified and actual.
  7. Inlet pressure.
  8. Discharge pressure.
  9. Sheave Make/Size/Bore.
  10. Number of Belts/Make/Size.
  11. Fan RPM.
- J. Duct Traverses:
1. System zone/branch.
  2. Duct size.
  3. Area.
  4. Design velocity.
  5. Design air flow.
  6. Test velocity.
  7. Test air flow.

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8. Duct static pressure.
9. Air temperature.
10. Air correction factor.
- K. Duct Leak Tests:
  1. Description of ductwork under test.
  2. Duct design operating pressure.
  3. Duct design test static pressure.
  4. Duct capacity, air flow.
  5. Maximum allowable leakage duct capacity times leak factor.
  6. Test apparatus:
    - a. Blower.
    - b. Orifice, tube size.
    - c. Orifice size.
    - d. Calibrated.
  7. Test static pressure.
  8. Test orifice differential pressure.
  9. Leakage.
- L. Terminal Unit Data:
  1. Manufacturer.
  2. Type, constant, variable, single, dual duct.
  3. Identification/number.
  4. Location.
  5. Model number.
  6. Size.
  7. Minimum static pressure.
  8. Minimum design air flow.
  9. Maximum design air flow.
  10. Maximum actual air flow.
  11. Inlet static pressure.
- M. Air Distribution Tests:
  1. Air terminal number.
  2. Room number/location.
  3. Terminal type.
  4. Terminal size.
  5. Area factor.
  6. Design velocity.
  7. Design air flow.
  8. Test (final) velocity.
  9. Test (final) air flow.
  10. Percent of design air flow.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Duct insulation.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping.
- B. Section 09 91 23 - Interior Painting: Painting insulation jackets.
- C. Section 23 05 53 - Identification for HVAC Piping and Equipment.
- D. Section 23 31 00 - HVAC Ducts and Casings: Glass mineral wool ducts.

**1.3. REFERENCE STANDARDS**

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.
- B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.
- C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.
- D. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2014.
- E. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2016.
- F. ASTM C 1338 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
- H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.
- J. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).
- K. American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE).
- L. North American Insulation Manufacturers Association (NAIMA).
- M. National Fire Protection Association (NFPA).
- N. Underwriter's Laboratories (UL Environment).
- O. Underwriter's Laboratories Environmental (UL Environment).

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

- C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

**1.5. QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified in this section.
- C. Surface-Burning Characteristics: For insulation and related materials, UL/ULC Classified per UL 723 or meeting ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
- D. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
- E. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- F. Formaldehyde Free: Third party certified with UL Environment Validation.
- G. Biosoluble: As determined by research conducted by the International Agency for Research on Cancer (IARC) and supported by revised reports from the National Toxicology Program (NTP) and the California Office of Environmental Health Hazard Assessment. Certified by European Certification Board for Mineral Wool Products (EUCEB).

**1.6. DELIVERY, STORAGE, AND HANDLING**

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

**1.7. FIELD CONDITIONS**

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

**1.8. DEFINITIONS**

- A. Thermal Conductivity (K value): Units of Btu-inch/hour per square foot per degree F.
- B. UL GREENGUARD: Provides independent third-party, Indoor Air Quality (IAQ) certification of products for emissions of respirable particles and Volatile Organic Compounds (VOC's), including formaldehyde and other specific product-related pollutants. Certification is based upon criteria used by EPA, OSHA, and WHO.
- C. ASJ+: All Service Jacket composed of aluminum foil reinforced with glass scrim bonded to a kraft paper interleaving with an outer film layer leaving no paper exposed.

- D. ASJ: All Service Jacket (no outer film).
- E. SSL+: Self-Sealing Lap with Advanced Closure System.
- F. SSL: Self-Sealing Lap.
- G. FSK: Foil Scrim Kraft; jacketing.
- H. PSK: Poly Scrim Kraft; jacketing.
- I. PVC: PolyVinyl Chloride.
- J. Glass Mineral Wool: Interchangeable with fiber glass, but replacing the term in the attempt to disassociate and differentiate Glass Mineral Wool from the potential health and safety of special purpose or reinforcement products that do not meet the bio solubility criteria of insulation made from glass. Rock Mineral Wool will replace the traditional Mineral Wool label. Both are used in lieu of the Mineral Mineral Wool label.
- K. UL Environment Claims Validation (ECV): service and label tests a manufacturer's product and validates that the environmental claims they make in their marketing and packaging materials are factual. This Environmental Claims Validation (ECV) service will allow manufacturers to verify that their products contain a quantifiable amount of recycled content and, as such, help limit raw material extraction and reduce landfill waste. It also will enable products to qualify for LEED® points under Pilot Credit 43: MR - Certified Products.
- L. Polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE fire retardants: have been linked to adverse health effects after exposure in low concentrations.
- M. UL Classified: UL has tested and evaluated samples of the product with respect to certain properties of the product. UL Classifies products to:
  - 1. Applicable UL requirements.
  - 2. Standards for safety.
  - 3. Standards of other National and International organizations.

## **PART 2 PRODUCTS**

### **2.1. REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION**

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

### **2.2. DUCT WRAP, FLEXIBLE**

- A. Manufacturer:
  - 1. Knauf Insulation; Atmosphere Duct Wrap with Ecosse Technology: [www.knaufusa.com](http://www.knaufusa.com).
  - 2. Johns Manville; "Microlite FSK": [www.jm.com](http://www.jm.com).
  - 3. Owens Corning Corporation; "SOFTTR" or "EcoTouch": [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
  - 4. CertainTeed Corporation; "Soft Touch": [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation: ASTM C553; flexible, noncombustible blanket.

1. 'K' value: 0.29 at 75 degrees F, when tested in accordance with ASTM C177.
2. Maximum Service Temperature: 250 degrees F.
3. Maximum Water Vapor Sorption: <5.0 percent by weight per ASTM C1104.
- C. Vapor Barrier Jacket:
  1. Kraft paper with glass fiber yarn and bonded to aluminized film (FSK).
  2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
  3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
  1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- E. Outdoor Vapor Barrier Mastic:
  1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- F. Tie Wire: Annealed steel, 16 gage.

**2.3. GLASS FIBER, RIGID**

- A. Manufacturer:
  1. Knauf Insulation; Model "Rigid Plenum Liner": [www.knaufusa.com](http://www.knaufusa.com).
  2. Johns Manville Corporation; Permacote Linacoustic R-300": [www.jm.com](http://www.jm.com).
  3. CertainTeed Corporation; Model "ToughGard® Rigid Liner Board": [www.certainteed.com](http://www.certainteed.com).
  4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation: ASTM C612; rigid, noncombustible blanket.
  1. ASTM C1071, Type II.
  2. 'K' value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
  3. Maximum service temperature: 450 degrees F.
  4. Maximum Water Vapor Sorption: 5.0 percent.
  5. Maximum Density: 8.0 lb/cu ft.
- C. Vapor Barrier Jacket:
  1. Kraft paper with glass fiber yarn and bonded to aluminized film.
  2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
  3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
  1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- E. Indoor Vapor Barrier Finish:
  1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
  2. Vinyl emulsion type acrylic, compatible with insulation, black color.
- F. UL/ULC Classified per UL 723. Comply with ASTM C 1071 Type I and Type II, NFPA 90A, and NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard." UL GREENGUARD Certified does not support the growth of mold, fungi, or bacteria per ASTM C 1338 and meets UL Environment GREENGUARD Microbial Resistance



Listing per UL 2824-“GREENGUARD Certification Program Method for Measuring Microbial Resistance “. UL/E validated to be formaldehyde free. DecaBDP Free.

**2.4. DUCT LINER**

- A. Manufacturers:
  - 1. Knauf Insulation: [www.knaufinsulation.com](http://www.knaufinsulation.com).
  - 2. Johns Manville: [www.jm.com](http://www.jm.com).
  - 3. Owens Corning Corp: [www.owenscorning.com](http://www.owenscorning.com).
  - 4. CertainTeed Corporation; Model "ToughGard® Duct Liner": [www.certainteed.com](http://www.certainteed.com).
  - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Insulation: Non-corrosive, incombustible glass mineral wool complying with ASTM C 1071; mat faced air stream surface and edges coated with acrylic polymer.
  - 1. Fungi Resistance: ASTM G 21.
  - 2. UL GREENGUARD Certified does not support the growth of mold, fungi, or bacteria per ASTM C 1338
  - 3. Meets UL Environment GREENGUARD Microbial Resistance Listing per UL
  - 4. 2824-“GREENGUARD Certification Program Method for Measuring Microbial Resistance “
  - 5. DecaBDP Free.
  - 6. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
  - 7. Service Temperature: Up to 250 degrees F.
  - 8. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
  - 9. Minimum Noise Reduction Coefficients:
    - 10. 1/2 inch Thickness: 0.45.
    - 11. 1 inch Thickness: 0.70.
    - 12. 1-1/2 inches Thickness: 0.80.
    - 13. 2 inch Thickness: 0.85.
- C. Liner Fasteners: Galvanized steel.

**PART 3 EXECUTION**

**3.1. EXAMINATION**

- A. Test ductwork for design pressure prior to applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

**3.2. INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Insulated Ducts Conveying Air Below Ambient Temperature:

1. Provide insulation with integral vapor barrier jackets.
  2. Finish with tape and vapor barrier jacket.
  3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
  4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- D. Insulated Ducts Conveying Air Above Ambient Temperature:
1. Provide with or without standard vapor barrier jacket.
  2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- E. Exterior Applications: Provide board insulation with vapor barrier jacket. Cover with with calked aluminum jacket with seams located on bottom side of horizontal duct section.
- F. External Duct Insulation Blanket or Board Application:
1. Secure insulation with vapor barrier with mechanical fasteners and seal jacket joints with vapor barrier tape to match jacket.
  2. Secure board insulation without vapor barrier with mechanical fasteners (pins and speed washers).
  3. Install without sag on underside of duct. Use mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
  4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive or FSK tape made for duct wrap or FSK board.
  5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- G. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 100 percent coverage.
  2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
  3. Seal and smooth joints. Seal and coat transverse joints.
  4. Seal liner surface penetrations with adhesive.
  5. Duct dimensions indicated are net inside dimensions required for air-flow. Increase duct size to allow for insulation thickness.
  6. Refer to SMACNA publication for transverse edges for velocities over 2500 fpm.

### **3.3. SCHEDULES**

- A. Exhaust Ducts Within 10 ft of Exterior Openings:
1. Flexible Glass Mineral Wool Duct Insulation: Minimum 2 inches thick or R-Value of 8.
- B. Outside Air Intake Ducts:
1. Flexible Glass Mineral Wool Duct Insulation: Minimum 2 inches thick or R-Value of 8.
- C. Supply Ducts:
1. Flexible Glass Mineral Wool Duct Insulation: Minimum 1.5 inches thick or R-Value of 5.
- D. Ducts Exposed to Outdoors:

1. Flexible or Rigid Glass Mineral Wool Duct Insulation: Minimum 2 inches thick or R-Value of 8.

**END OF SECTION**

**FUEL PIPING****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Pipe, pipe fittings, valves, and connections for piping systems.
- B. Natural gas piping above grade.
- C. Flexible pipe/connectors.
- D. Unions and flanges.
- E. Natural gas pressure regulators.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping.
- B. Section 09 90 00 - Painting and Coating.
- C. Section 23 05 48 - Vibration Isolation and Sound and Seismic Controls for HVAC Piping and Equipment.
- D. Section 23 05 49 - HVAC Seismic Restraint.
- E. Section 23 05 53 - Identification for HVAC Piping and Equipment.
- F. Section 26: Electrical characteristics and wiring connections.

**1.3. REFERENCE STANDARDS**

- A. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 2013.
- B. ASME B31.1 - Power Piping; The American Society of Mechanical Engineers; 2013 (ANSI/ASME B31.1).
- C. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2013 (ANSI/ASME B31.9).
- D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2013.
- E. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
- F. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2012.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Project Record Documents: Record actual locations of valves.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

**1.5. QUALITY ASSURANCE**

- A. Perform work in accordance with all applicable local codes and standards.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.

**FUEL PIPING**

- C. Identify pipe with marking including size, ASTM material classification, ASTM specification, water pressure rating.

**1.6. REGULATORY REQUIREMENTS**

- A. Perform Work in accordance with applicable plumbing code.

**1.7. DELIVERY, STORAGE, AND HANDLING**

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. Store pipe on sleepers, a minimum of 4 inches above surrounding grade, at all times.

**PART 2 PRODUCTS****2.1. NATURAL GAS PIPING, ABOVE GRADE**

- A. Steel Pipe: ASTM A 53/A 53M Schedule 40 black.
  - 1. Fittings: ASME B16.3, malleable iron, or ASTM A 234/A 234M, wrought steel welding type.
  - 2. Joints: NFPA 54, threaded or welded to ASME B31.1.

**2.2. STAINLESS STEEL GAS CONNECTORS**

- A. Manufacturers:
  - 1. Dormont, or approved equal.
- B. Features and Specifications:
  - 1. Tubing: Annealed, 304 stainless steel (ASTM A240).
  - 2. Flare Nuts: Brass or plated steel.
  - 3. Adaptors: Brass or plated steel.
  - 4. Coating: Heavy-duty, antimicrobial, hot-dipped gray PVC (for 1/2" OD (21 series) and 5/8" OD (31 series only). Coating will not hold a flame.
  - 5. Approved for indoor/outdoor use with stationary gas appliances/equipment.
  - 6. Temperature rating of connector with adapters: -40°F to 150°F.
  - 7. Temperature rating with valves: -40°F to 125°F.
  - 8. 100% factory leak tested
  - 9. When installing a new appliance or when an existing appliance is moved to a new location a NEW gas connector must be used per manufacturer's installation instructions and per product standards ANSI Z21.24/CSA 6.10 and ANSI Z21.75/CSA 6.27
  - 10. Designed for occasional movement after installation. Repeated bending, flexing or extreme vibration must be avoided. Normal operation of a clothes dryer, rooftop

**FUEL PIPING**

HVAC unit or SIMILAR OUTDOOR APPLIANCE DOES NOT constitute extreme vibration or movement

- C. Design Certifications and Approvals:
1. ANSI Z21.24/CSA 6.10 - Connectors for Gas Appliances
  2. ANSI Z21.75/CSA 6.27 - Connectors for Outdoor Appliances and Manufactured Homes

**2.3. PRESSURE REGULATORS**

- A. Manufacturers:
1. Equimeter.
  2. American.
  3. Maxitrol.
  4. Sensus.
- B. Product Description: Spring loaded, general purpose, self-operating service regulator including internal relief type diaphragm assembly and vent valve. Diaphragm case can be rotated 360 degrees in relation to body.
1. Comply with ANSI Z21.80.
  2. Temperatures: Minus 20 degrees F to 150 degrees F.
  3. Body: Cast iron with neoprene gasket.
  4. Spring case, lowered diaphragm casing, union ring, seat ring and disk holder: Aluminum.
  5. Disk, Diaphragm, and O-Ring: Nitrile.
  6. Minimum Inlet Pressure: 2 psi.
  7. Furnish sizes 2 inches and smaller with threaded ends. Furnish sizes 2-1/2 inches and larger with flanged ends.
- C. Incoming Service Pressure Regulators: Comply with ANSI Z21.80.
1. Manufacturers:
    - a. Equimeter.
    - b. American.
    - c. Maxitrol.
    - d. Sensus.
  2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
  3. Springs: Zinc-plated steel, interchangeable.
  4. Diaphragm Plate: Zinc-plated steel.
  5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
  6. Orifice: Aluminum; interchangeable.
  7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
  8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
  9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
  10. Overpressure Protection Device: Factory mounted on pressure regulator.

**FUEL PIPING**

11. Atmospheric Vent: Factory or field installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 60 psig.

**2.4. VALVES****A. Manual Shut-off Valves Inside Building.**

1. Manufacturer:
  - a. Nordstrom.
  - b. Fisher
  - c. Grinnel
2. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
  - a. CWP Rating: 125 psig.
  - b. Threaded Ends: Comply with ASME B1.20.1.
  - c. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
  - d. Tamperproof Feature: Locking feature for valves where required by Con. Ed.
  - e. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
  - f. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
  - g. Threaded cast iron body, 125 PSIG WOG.
3. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
  - a. CWP Rating: 125 psig.
  - b. Flanged Ends: Comply with ASME B16.5 for steel flanges.
  - c. Tamperproof Feature: Locking feature for valves where required by Con. Ed.
  - d. Service Mark: Initials "WOG" shall be permanently marked on valve body.
  - e. 2½ in. to 4-in.: Flanged cast iron body lubricated tapered plug type, 175 psig WOG.
  - f. 6 in. and larger: Flanged cast iron body lubricated tapered plug type, 200 psig WOG, worm gear operated.
4. Provide 2 wrenches for each size used.
  - a. Attach wrench to each valve.

**B. Ball Valves**

1. Manufacturer:
  - a. Contromatics.
  - b. Conbraco
  - c. NIBCO

**C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.**

1. 2 inch and smaller: Threaded brass ball valves with full port TFE seats and blowout proof stem, 600 psig WOG, AGA approved.
2. Manufacturers:

**FUEL PIPING**

- a. BrassCraft.
    - b. Conbraco.
    - c. NIBCO.
  3. Body: Bronze, complying with ASTM B 584.
  4. Ball: Chrome-plated bronze.
  5. Stem: Bronze; blowout proof.
  6. Seats: Reinforced TFE; blowout proof.
  7. Packing: Threaded-body packnut design with adjustable-stem packing.
  8. Ends: Threaded, flared, or socket.
  9. CWP Rating: 600 psig.
  10. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  11. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- D. Bronze Plug Valves: MSS SP-78.
  1. Manufacturers:
    - a. Hammond.
    - b. Lee Brass Company.
    - c. NIBCO.
  2. Body: Bronze, complying with ASTM B 584.
  3. Plug: Bronze.
  4. Ends: Threaded, socket, or flanged.
  5. Operator: Square head or lug type with tamperproof feature where indicated.
  6. Pressure Class: 125 psig.
  7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction, AGA approved.
  8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Cast-Iron, Non-lubricated Plug Valves: MSS SP-78.
  1. Manufacturers:
    - a. McDonald.
    - b. Mueller Co.
    - c. Xomox Corporation.
  2. Body: Cast iron, complying with ASTM A126, Class B.
  3. Plug: Bronze or nickel-plated cast iron.
  4. Seat: Coated with thermoplastic.
  5. Stem Seal: Compatible with natural gas.
  6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  7. Operator: Square head or lug type with tamperproof feature where indicated.
  8. Pressure Class: 125 psig.
  9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- F. Cast Lubricated Plug Valves Inside Building:



**FUEL PIPING**

1. 2-inch and smaller: Cast iron body, threaded, equal to Nordstrom Valves, Inc. Figure 114.
2. 2½ inch to 4-inch: Flanged cast iron body lubricated tapered plug type, 175 psig WOG, equal to Nordstrom Valves, Inc. Figure 115.
3. 6 inch and larger: Flanged cast iron body lubricated tapered plug type, 200 psig WOG, worm gear operated, equal to Nordstrom Valves, Inc. Figure 165.
4. Valves 2 ½ inch and larger shall be flanged.
5. Provide 2 wrenches for each size used.
6. Attach wrench to each valve.
7. Gas Cocks:
  - a. Gas cocks shall be for use only as manual gas shut-off valves at each piece of gas burning equipment; shall be of the plug type, bronze construction with check, nut and washer bottom and tee handle.
  - b. Gas cocks shall be Figure 10596 as manufactured by A.Y. McDonald Mfg. Co., or Series 52 as manufactured by Conbraco Industries, Inc.
  - c. Gas cocks shall only be used on piping 1 inch and smaller.

**2.5. EARTHQUAKE VALVES**

- A. Earthquake Valves: Comply with ASCE 25.
1. Manufacturers:
    - a. Pacific Seismic Products, Inc.
    - b. Quake Defense, Inc.
    - c. Strand Earthquake.
  2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  3. Maximum Operating Pressure: 60 psi.
  4. Cast-aluminum body with stainless-steel internal parts.
  5. Nitrile-rubber, reset-stem o-ring seal.
  6. Valve position, open or closed, indicator.
  7. Composition valve seat with clapper held by spring or magnet locking mechanism.
  8. Level indicator.
  9. End Connections: Threaded for valves NPS 2 inches and smaller; flanged for valves NPS 2-1/2 inches and larger.

**2.6. FLANGES, UNIONS, AND COUPLINGS**

- A. Unions for Pipe Sizes 3 Inches and Under:
1. Ferrous pipe: Class 150 malleable iron threaded unions.
  2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Size Over 1 Inch:
1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
  2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

**FUEL PIPING**

- C. Dielectric Connections: Bronze threaded nipple, minimum 3 inches long, with impervious isolation liner. Victaulic "Clearflow".

**2.7. PIPE HANGERS AND SUPPORTS**

- A. Manufacturers:
1. Tolco Inc.
  2. Anvil.
  3. Hubbard Enterprises/Holdrite.
  4. Michigan Hanger Company, Inc.
  5. PHD Manufacturing Co.
  6. Superstrut.
  7. Unistrut.
  8. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Fuel Piping:
1. Conform to ASME B31.9.
  2. Hangers for Pipe Sizes 1/2 inch to 3 inches. Malleable iron, adjustable swivel, split ring.
  3. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
  4. Use non-metallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

**2.8. ACCESSORIES**

- A. Hanger Rods: Mild steel, threaded both ends, threaded on one end, or continuous threaded.

**2.9. INSERTS**

- A. Manufacturers:
1. Anvil Fig. 281.
  2. PHD Fig 951.
  3. Michigan Hanger Model 355EG.
  4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Inserts: Carbon steel case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

**2.10. FLASHING**

- A. Metal Flashing: 26 gage thick galvanized steel.
- B. Metal Counterflashing: 22 gage thick galvanized steel.
- C. Lead Flashing:
1. Waterproofing: 5 lb./sq.ft. sheet lead
  2. Soundproofing: 1 lb./sq.ft. sheet lead.
- D. Flexible Flashing: 1.85 inch thick sheet butyl; compatible with roofing.

**FUEL PIPING**

- E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

**2.11. SLEEVES**

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sealant: Acrylic; refer to Section 07 90 05.

**2.12. MECHANICAL SLEEVE SEALS**

- A. Manufacturers:
  - 1. Thunderline Link-Seal, Inc. Model Series LS.
  - 2. NMP Corporation.
  - 3. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

**2.13. FORMED STEEL CHANNEL**

- A. Manufacturers:
  - 1. Unistrut Model Series P1000.
  - 2. Superstrut Model Series 1200.
  - 3. Michigan Hanger "O-Strut" Model A-12.
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

**2.14. FIRESTOPPING**

- A. Manufacturers:
  - 1. Specified Technology Inc. (STI) Model SpecSeal Series 100.
  - 2. Dow Corning Corp.
  - 3. Hilti Corp.
  - 4. International Protective Coating Corp.
  - 5. 3M fire Protection Products.
  - 6. Metacaulk Fire Stopping: [www.rectorseal.com](http://www.rectorseal.com).
  - 7. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
  - 1. Silicone Firestopping Elastomeric Firestopping: Single or multiple component silicone elastomeric compound and compatible silicone sealant.
  - 2. Foam Firestopping Compounds: Single or Multiple component foam compound.
  - 3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.

**FUEL PIPING**

4. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
  5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
  6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
  7. Firestop Pillows: Formed mineral fiber pillows.
- C. Color: As selected from manufacturer's full range of colors.

**2.15. FIRESTOPPING ACCESSORIES**

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- B. Dam Material: Permanent:
1. Mineral fiberboard.
  2. Mineral fiber matting.
  3. Sheet metal.
  4. Plywood or particle board.
  5. Alumina silicate fire board.
- C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- D. General:
1. Furnish UL listed products.
  2. Select products with rating not less than rating of wall or floor being penetrated.
- E. Non-Rated Surfaces:
1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
  2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

**PART 3 EXECUTION****3.1. EXAMINATION**

- A. Verify that excavations are to required grade, dry, and not over-excavated.

**3.2. PREPARATION**

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

**FUEL PIPING****3.3. INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- C. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 00.
- G. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- H. Provide support for utility meters in accordance with requirements of utility companies.
- I. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00.
- J. Install valves with stems upright or horizontal, not inverted.
- K. Sleeve pipes passing through partitions, walls and floors.
- L. Pipe Hangers and Supports:
  - 1. Install in accordance with ASME B31.9 and MSS SP-89.
  - 2. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
    - a. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
    - b. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743); minimum rod size, 3/8 inch (10 mm).
    - c. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
    - d. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
  - 3. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
    - a. NPS 3/8 (DN 10): Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).
    - b. NPS 1/2 (DN 15): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
    - c. NPS 3/4 (DN 20) and Larger: Maximum span, 96 inches (2440 mm); minimum rod, 3/8 inch, (10 MM).
  - 4. Place hangers within 12 inches of each horizontal elbow.
  - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

**FUEL PIPING**

7. Prime coat exposed steel hangers and supports. Refer to Section 09 90 00. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
8. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 23 05 48.
9. Support of pipe tubing and equipment is to be accomplished by means of engineered products specific to each application. Makeshift field devised methods will not be allowed.

**3.4. APPLICATION**

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- C. Provide plug valves in natural gas systems for shut-off service.

**3.5. SERVICE CONNECTIONS**

- A. Provide new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 2 psi. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Metal ductwork.
- B. Duct cleaning.
- C. Duct systems have been designed for metal duct.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping.
- B. Section 09 90 00 - Painting and Coating: Weld priming, weather resistant, paint or coating.
- C. Section 23 05 48 - Vibration Isolation and Sound and Seismic Controls for HVAC Piping and Equipment.
- D. Section 23 05 49 - HVAC Seismic Restraint.
- E. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.
- F. Section 23 07 13 - Duct Insulation: External insulation and duct liner.
- G. Section 23 33 00 - Air Duct Accessories.
- H. Section 23 36 00 - Air Terminal Units.
- I. Section 23 37 00 - Air Outlets and Inlets.

**1.3. REFERENCE STANDARDS**

- A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
- E. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2018.
- F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).
- G. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

**1.4. COORDINATION**

- A. The Drawings do not attempt to show exact details of all ductwork. No extra payment will be allowed for obstruction by work of other trades or local obstructions to the work which require offsets. Where diagrams have been made to show duct connections, the Contractor is cautioned that these diagrams must not be used for obtaining material quantities.

- B. Changes in location of equipment or ductwork, advisable in the opinion of the Contractor, shall be submitted to the Engineer for review before proceeding with the work. All measurements and dimensions shall be verified at the site.
- C. Duct sizes shown on the Drawings represent the nominal free area required for that service. Where changes in duct dimensions are necessary to coordinate the installation, the contractor is allowed, with prior permission from the project engineer, to use alternative equivalent sized ducts.
- D. Coordination with Existing Conditions and with other Trades:
  - 1. Coordinate the installation of ductwork with existing conditions and the work of other trades to allow the installation of ductwork and the proper operation of dampers and operators.
  - 2. Where existing thread rod, strut material, miscellaneous supports, conduit, or piping under 1-inch diameter obstructs the passage of the ductwork, they shall be relocated by the Contractor at no additional cost to the Owner. Coordinate the work with other trades.

### **1.5. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for duct materials, duct liner, duct connections, and duct fittings.
- C. Shop Drawings: Submit duct fabrication drawings, drawn to scale not smaller than 1/4 inch equals 1 foot, on drawing sheets same size as Contract Documents, indicating:
  - 1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
  - 2. Duct layout, indicating pressure classifications and sizes in plan view.
  - 3. Fittings.
  - 4. Reinforcing details and spacing.
  - 5. Seam and joint construction details.
  - 6. Penetrations through fire rated and other walls.
  - 7. Terminal unit, coil, and humidifier installations.
  - 8. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.
- D. Manufacturer's Installation Instructions: Indicate special procedures for glass fiber ducts.
- E. Manufacturer's Certificate: Certify that installation of glass fiber ductwork meet or exceed recommended fabrication and installation requirements.
- F. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

### **1.6. QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.



**1.7. REGULATORY REQUIREMENTS**

- A. Construct ductwork to NFPA 90B standards.

**1.8. FIELD CONDITIONS**

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

**PART 2 PRODUCTS**

**2.1. MATERIALS**

- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.
- B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
  - 1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
  - 2. VOC Content: Not more than 250 g/L, excluding water.
  - 3. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E84.
  - 4. For Use With Flexible Ducts: UL labeled.
  - 5. Manufacturers:
    - a. Duro-Dyne; Model DSW: [www.durodyne.com](http://www.durodyne.com).
    - b. Hard Cast; Model RTA 50: [www.hardcast.com](http://www.hardcast.com).
    - c. Hard Cast; Model "Versa-Grip" 102: [www.hardcast.com](http://www.hardcast.com).
    - d. Sika; Model "Sikaflex": [www.sika.com](http://www.sika.com).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
- D. All Ducts: G90 Galvanized steel, unless otherwise indicated. Provide SMACNA pressure class as indicated or at a minimum meet or exceed the pressure rating of the connected fan. In no case less than 1/2 inch w.g. permitted.
- E. General Exhaust: 1/2 inch w.g. pressure class, galvanized steel.
- F. Fume Hood Exhaust: 1/2 inch w.g. pressure class, galvanized steel, unless noted otherwise.
- G. Outside Air Intake: 1/2 inch w.g. pressure class, galvanized steel.
- H. Evaporative Condenser Intake and Exhaust: 1/2 inch w.g. pressure class, galvanized steel.

**2.2. DUCTWORK FABRICATION**

- A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.

- B. Transfer Air and Sound Boots: 1/2 inch w.g. pressure class, fibrous glass.
- C. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.
- D. Duct systems have been designed for metal duct.
- E. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- F. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
- G. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
- H. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- I. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).
- J. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.
- K. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

### **2.3. DUCT MANUFACTURERS**

- A. Streimer Sheet Metal: [www.streimer.com](http://www.streimer.com).
- B. General Sheet Metal: [www.gsmw.com](http://www.gsmw.com).
- C. Arctic Sheet Metal: [www.arcticsheetmetal.com](http://www.arcticsheetmetal.com).
- D. CoolSys Sheet Metal: [www.coolsys.com](http://www.coolsys.com).
- E. Robert Lloyd Sheet Metal: [www.rlsn.net](http://www.rlsn.net).
- F. Just Right Heating and Cooling: [www.justrightheat.com](http://www.justrightheat.com).

### **2.4. ROUND AND FLAT OVAL SPIRAL SEAM DUCT**

- A. Manufacture: Machine made from round spiral lock seam duct in accordance with SMACNA (DCS).
- B. Fittings: Manufacture at least two gages heavier metal than duct.
  - 1. All fittings shall have rolled edges for added strength and rigidity.
  - 2. All takeoffs to be completely separate fitting; direct tabs are not allowed. Saddle fittings are not allowed except for retrofit installations when approved by project engineer.
  - 3. Branch takeoffs are to be 45 degree laterals or conical tees, 90 and 45 degree.
  - 4. Elbows shall be radiused at 1.5 times the diameter. 15, 30 and 60 degree elbows shall be 1.0 times the diameter.
  - 5. Joints are to be couplings with centering beads and double-lipped, U-profile EPDM rubber gasket. Use flange joints from 26 inch diameter and large. Crimped ends are prohibited except 8 inches and smaller.

**2.5. RECTANGULAR HVAC DUCTWORK**

- A. Manufacture: Equal or exceed the minimum wall thickness and reinforcing as scheduled in the SMACNA rectangular duct construction schedule to comply with duct pressure classifications specified. Cross break or bead all duct widths over 14 inches and horizontal surfaces to prevent ballooning or breathing.
- B. Fittings: Fabricate for easiest airflow.
  - 1. Branch tabs are to be 45 degrees entry with  $L = 1/4 W$  inches.
- C. Joints:
  - 1. Longitudinal: Pittsburg lock flooded with mastic. Snaplock is not allowed.
  - 2. Traverse: Demountable joint such as Ductmate for 36 inch width and above. Seal corners prior to assembly.

**2.6. MANUFACTURED DUCTWORK AND FITTINGS**

- A. Double Wall Insulated Round and Flat Oval Ducts: Machine made from round spiral lockseam duct.
  - 1. Manufacture in accordance with SMACNA (DCS).
  - 2. Fittings: Manufacture with solid inner wall.
  - 3. Inner Wall: Perforated galvanized steel.
  - 4. Insulation:
    - a. Thickness: 1 inch fiberglass.
- B. Fiber Glass Reinforced Plastic (FRP) Ducts: Glass fiber reinforced plastic, minimum 3/16 inch wall thickness.
- C. Flexible Ducts: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.
  - 1. Insulation: Fiberglass insulation with polyethylene or aluminized vapor barrier film.
  - 2. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
  - 3. Maximum Velocity: 4000 fpm.
  - 4. Temperature Range: -20 degrees F to 210 degrees F.
  - 5. Minimum Insulation: R-6
  - 6. Manufacturers:
    - a. Thermaflex, M-KE.
    - b. Substitutions: See Section 01 60 00 - Product Requirements.

**2.7. FIBROUS GLASS DUCTS (WHEN PERMITTED)**

- A. Fibrous Glass Ducts: 1 inch thick rigid glass fiber with aluminum foil, glass scrim and Kraft or plastic jacket vapor barrier; maximum 0.23 K value at 75 degrees F.
  - 1. UL labeled to UL 181.
  - 2. Manufacturers:
    - a. Knauf Model Air Duct Board - AGM.
    - b. Johns Manville Model Super Duct RC.
    - c. Owens Corning Model QuietZone.

- d. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Fabricate in accordance with SMACNA (FGD), except as indicated.
- C. Machine fabricate fibrous glass ducts and fittings. Make only minor on site manual adjustments.
- D. Staple duct joints and tape with 3 inch wide heat activated chemical bonding tape.
- E. Do not use fibrous glass ducts within 12 inches of electric or fuel fired heaters.
- F. Maximum stress exerted on structural steel members: 22000 psi.
- G. Maximum temperature: 250 degrees Fahrenheit.
- H. Comply with safety standards NFPA 90A and NFPA 90B.

### **PART 3 EXECUTION**

#### **3.1. INSTALLATION**

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install in accordance with manufacturer's instructions.
- C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- D. Fibrous Glass Ducts: Install in accordance with SMACNA Fibrous Glass Duct Construction Standards.
- E. Flexible Ducts: Connect to metal ducts with adhesive and draw bands
- F. Use sealant on all lapped round duct joint connections. Seal all ducts in accordance with State Energy Code.
- G. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- H. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings 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 material inside a metal ring.
- I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- J. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.
- K. Install duct hangers and supports in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- L. Use double nuts and lock washers on threaded rod supports.
- M. Connect terminal units supply ducts rigidly without flexible duct.
- N. Connect diffusers or light troffer boots to low pressure ducts with 5 feet maximum length of flexible duct held in place with strap or clamp.
- O. At exterior wall louvers, seal duct to louver frame.
- P. For exposed ductwork provide escutcheon or flange at wall penetrations.

**3.2. CLEANING**

- A. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Backdraft dampers - metal.
- B. Combination fire and smoke dampers.
- C. Duct access doors.
- D. Duct test holes.
- E. Flexible duct connectors.
- F. Volume control dampers.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping.
- B. Section 23 05 48 - Vibration Isolation and Sound and Seismic Controls for HVAC Piping and Equipment.
- C. Section 23 31 00 - HVAC Ducts and Casings.
- D. Section 23 36 00 - Air Terminal Units: Pressure regulating damper assemblies.
- E. Division 26 - Electrical characteristics and wiring connections.

**1.3. REFERENCE STANDARDS**

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2021.
- B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).
- C. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.
- D. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.
- C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors, and duct test holes.
- D. Manufacturer's Installation Instructions: Provide instructions for fire dampers and combination fire and smoke dampers.
- E. Project Record Drawings: Record actual locations of access doors, test holes, fire dampers, and fire and smoke dampers.

**1.5. QUALITY ASSURANCE**

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

- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

**1.6. DELIVERY, STORAGE, AND HANDLING**

- A. Protect dampers from damage to operating linkages and blades.

**PART 2 PRODUCTS**

**2.1. TURNING VANES**

- A. Manufacturers:
  - 1. Elgen All-Tight.
  - 2. Duro-Dyne Type VR.
  - 3. Or approved equivalent.
- B. Hat channel or embossed vane side rails with shop-fabricated, double-blade turning vanes of galvanized steel aligned in the short dimension. Individually adjustable.

**2.2. BACKDRAFT DAMPERS - METAL**

- A. Manufacturers:
  - 1. PCI Industries, Inc.; Pottorff Brand Model Series BD60: [www.pottorff.com](http://www.pottorff.com).
  - 2. Cesco; Model BAP-1: [www.cescoproducts.com](http://www.cescoproducts.com).
  - 3. Greenheck; Model Series EM: [www.greenheck.com](http://www.greenheck.com).
  - 4. Ruskin Company; BD/BDR: [www.ruskin.com](http://www.ruskin.com).
  - 5. Nailor; Model 1370/1380: [www.nailor.com](http://www.nailor.com).
  - 6. Tamco; Model BDD Series 7000 (aluminum): [www.tamco.ca](http://www.tamco.ca).
  - 7. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.
- C. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

**2.3. COMBINATION FIRE AND SMOKE DAMPERS**

- A. Manufacturers:
  - 1. PCI Industries, Inc.; Pottorff Brand Model Series FSD: [www.pottorff.com](http://www.pottorff.com).
  - 2. Cesco; Model Series CG: [www.cescoproducts.com](http://www.cescoproducts.com).
  - 3. Greenheck; Model FSD-211: [www.greenheck.com](http://www.greenheck.com).
  - 4. Ruskin Company: [www.ruskin.com](http://www.ruskin.com).
  - 5. Nailor; 1220 Series: [www.nailor.com](http://www.nailor.com).
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

**AIR DUCT ACCESSORIES**

- C. Provide factory sleeve and collar for each damper.
- D. Multiple Blade Dampers: Fabricate with 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.
- E. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct and link to damper operating shaft.
- F. Normally Closed Smoke Responsive Fire Dampers: Curtain type, opening by gravity upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure.
- G. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.
- H. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

**2.4. DUCT ACCESS DOORS**

- A. Manufacturers:
  - 1. Cesco; Model Series HF: [www.cescoproducts.com](http://www.cescoproducts.com).
  - 2. Greenheck; Model Series HAD/CAD: [www.greenheck.com](http://www.greenheck.com).
  - 3. Ruskin Company: [www.ruskin.com](http://www.ruskin.com).
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
  - 1. Less Than 12 inches Square: Secure with sash locks.
  - 2. Up to 18 inches Square: Provide two hinges and two sash locks.
  - 3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.
  - 4. Larger Sizes: Provide an additional hinge.
- C. Access doors with sheet metal screw fasteners are not acceptable.

**2.5. DUCT TEST HOLES**

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

**2.6. FLEXIBLE DUCT CONNECTORS**

- A. Manufacturers:
  - 1. Ventfabrics Ventlon.



**AIR DUCT ACCESSORIES**

2. Duro-Dyne Durolon.
3. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric: [www.carlislehvac.com/#sle](http://www.carlislehvac.com/#sle).
4. Elgen Manufacturing: [www.elgenmfg.com](http://www.elgenmfg.com).
5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Flexible Duct Connections: Fabric crimped into metal edging strip.
  1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
    - a. Net Fabric Width: Approximately 3 inches wide.
  2. Metal: 3 inches wide, 24 gage thick galvanized steel.
- D. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.
- E. Maximum Installed Length: 14 inch.

**2.7. VOLUME CONTROL DAMPERS**

- A. Manufacturers:
  1. Cesco; Model Series MGF/MGG: [www.cescoproducts.com](http://www.cescoproducts.com).
  2. Greenheck; Model Series MBD/MBDR: [www.greenheck.com](http://www.greenheck.com).
  3. Nailor; Model 1110/1120 galvanized: [www.nailor.com](http://www.nailor.com).
  4. Tamco; Series 1000 (aluminum): [www.tamco.com](http://www.tamco.com).
  5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Splitter Dampers:
  1. Material: Same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.
  2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
  3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.
  4. Manufacturers:
    - a. Krueger.
- D. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.
  1. Fabricate for duct sizes up to 6 by 30 inch.
  2. Blade: 24 gage, minimum.
  3. Provide 1 1/2 inch standoff bracket with extended pin or approved equal.
  4. Manufacturers:
    - a. Greenheck MBD-10 or approved equal..
- E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
  1. Blade: 18 gage, minimum.
  2. Provide 1 1/2 inch standoff bracket with extended pin or approved equal.
  3. Manufacturers:

**AIR DUCT ACCESSORIES**

- a. Greenheck MBD-15 or approved equal for 2-inch pressure.
- F. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
  - 1. Product: 515A manufactured by Young Regulator.
- G. Quadrants:
  - 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
  - 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
  - 3. Where rod lengths exceed 30 inches provide regulator at both ends.
  - 4. Manufacturers:
    - a. 443 Valcalox Regulator manufactured by Young Regulator.
    - b. Substitutions: See Section 01 60 00 - Product Requirements.

**PART 3 EXECUTION****3.1. PREPARATION**

- A. Verify that electric power is available and of the correct characteristics.

**3.2. INSTALLATION**

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 31 00 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.
- D. Provide duct test holes where indicated and required for testing and balancing purposes.
- E. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.
- G. Demonstrate re-setting of fire dampers to Owner's representative.
- H. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- I. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

**AIR DUCT ACCESSORIES**

- J. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- K. Provide balancing dampers on high velocity systems where indicated. Refer to Section 23 36 00 - Air Terminal Units.
- L. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Roof exhausters.
- B. Cabinet exhaust fans.
- C. Ceiling exhaust fans.
- D. In-line exhaust fans.

**1.2. RELATED REQUIREMENTS**

- A. Section 23 05 48 - Vibration Isolation and Sound and Seismic Controls for HVAC Piping and Equipment.
- B. Section 23 33 00 - Air Duct Accessories: Backdraft dampers.
- C. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

**1.3. REFERENCE STANDARDS**

- A. AMCA 99 - Standards Handbook; 2016.
- B. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005.
- C. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016.
- D. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc.; <http://www.amca.org/certified/search/company.aspx>.
- E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.
- F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.
- G. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- C. Manufacturer's Instructions: Indicate installation instructions.
- D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Fan Belts: Two sets for each individual fan.

**1.5. QUALITY ASSURANCE**

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

- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

## **PART 2 PRODUCTS**

### **2.1. POWER VENTILATORS - GENERAL**

- A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.
- B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- C. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing AMCA Certified Sound Rating Seal.
- D. Fabrication: Conform to AMCA 99.
- E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- G. Kitchen Hood Exhaust Fans: Comply with requirements of NFPA 96 and UL 762.

### **2.2. ROOF EXHAUSTERS**

- A. Manufacturers:
  - 1. Greenheck; Model G or GB: [www.greenheck.com](http://www.greenheck.com).
  - 2. Carnes; Model Series VE: [www.carnes.com](http://www.carnes.com).
  - 3. Loren Cook Company; Model Series AC: [www.lorencook.com](http://www.lorencook.com).
  - 4. JenCoFan; Model RED or DB: [www.jencofan.com](http://www.jencofan.com).
  - 5. PennBarry; Model Domex: [www.pennbarry.com](http://www.pennbarry.com).
  - 6. Twin City Fan Company; Model DCRD/BCRD or DCRU/BCRU: [www.tcf.com](http://www.tcf.com).
  - 7. Acme; Model PV or PRN. [www.acmefan.com](http://www.acmefan.com).
  - 8. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.
- C. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.
- D. Roof Curb: 12 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, interior baffle with acoustic insulation, curb bottom, and factory installed nailer strip.
- E. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor and wall mounted multiple speed switch.
- F. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

**HVAC POWER VENTILATORS**

- G. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

**2.3. CABINET EXHAUST FANS****A. Manufacturers:**

1. Greenheck; Model Series SP/CSP: [www.greenheck.com](http://www.greenheck.com).
2. Carnes; Model Series VCDD: [www.carnes.com](http://www.carnes.com).
3. Loren Cook Company; Model Series GC/GN: [www.lorencook.com](http://www.lorencook.com).
4. JenCoFan; Model Series FF/FFC: [www.jencofan.com](http://www.jencofan.com).
5. PennBarry; Model Zephyr: [www.pennbarry.com](http://www.pennbarry.com).
6. Twin City Fan Company; Type T and TL: [www.tcf.com](http://www.tcf.com).
7. Acme; Model Series VQ/VQL: [www.acmefan.com](http://www.acmefan.com).
8. Substitutions: See Section 01 60 00 - Product Requirements.

**B. Construction:**

1. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing , resilient mounted motor, gravity backdraft damper in discharge.
2. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.
3. Grille: Aluminum with baked white enamel finish.
4. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

**C. Performance:**

1. As indicated on the Drawing Schedule.

**D. Electrical Characteristics and Components:**

1. Electrical Characteristics: In accordance with Division 26.
2. Motors: In accordance with Section 22 05 13/23 05 13. Type: NEMA MG1.
3. Controls: [\_\_\_\_\_].
4. Disconnect Switch: Factory mount disconnect switch on equipment.

**2.4. IN-LINE EXHAUST FANS (BI WHEEL WITH HIGH VOL/STATIC)****A. Manufacturers:**

1. Greenheck; Model Series SQ/BSQ: [www.greenheck.com](http://www.greenheck.com).
2. Carnes; Model Series VIDK/VIBK: [www.carnes.com](http://www.carnes.com).
3. Loren Cook Company; Model Series SQN: [www.lorencook.com](http://www.lorencook.com).
4. JenCoFan; Model Series JID/JIB: [www.jencofan.com](http://www.jencofan.com).
5. PennBarry; Model Centrex Inliner: [www.pennbarry.com](http://www.pennbarry.com).
6. Twin City Fan Company; Type DSI and BSI: [www.tcf.com](http://www.tcf.com).
7. Acme; Model Series XD/XB: [www.acmefan.com](http://www.acmefan.com).
8. Substitutions: See Section 01 60 00 - Product Requirements.

**B. Construction:**

**HVAC POWER VENTILATORS**

1. Centrifugal Fan Unit: V-belt or direct driven backward incline wheel with galvanized steel housing and support lugs, lined with 1/2 inch acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
  2. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.
  3. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
- C. Performance:
1. As indicated on the Drawing Schedule.
- D. Electrical Characteristics and Components:
1. Electrical Characteristics: In accordance with Division 26.
  2. Motors: In accordance with Section 22 05 13/23 05 13. Type: NEMA MG1.
  3. Controls: \_\_\_\_\_.
  4. Disconnect Switch: Factory mount disconnect switch on equipment.

**PART 3 EXECUTION****3.1. INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.
- C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.
- D. Hung Cabinet Fans:
  1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 23 05 48.
  2. Install flexible connections specified in Section 23 33 00 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- E. Provide sheaves required for final air balance.
- F. Install backdraft dampers on inlet to roof and wall exhausters.
- G. Provide backdraft dampers on outlet from cabinet and ceiling exhausters fans and as indicated.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Variable volume terminal units.
- B. Integral sound attenuator.
- C. Integral heating coils.
- D. Integral damper motor operators.
- E. Integral controls.

**1.2. RELATED REQUIREMENTS**

- A. Section 23 05 48 - Vibration Isolation and Sound and Seismic Controls for HVAC Piping and Equipment.
- B. Section 23 31 00 - HVAC Ducts and Casings.
- C. Section 23 33 00 - Air Duct Accessories.
- D. Section 23 37 00 - Air Outlets and Inlets.
- E. Section 23 09 13 - Instrumentation and Control Devices for HVAC: Thermostats and Actuators.
- F. Division 26: Electrical characteristics and wiring connections.

**1.3. REFERENCE STANDARDS**

- A. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995 (Reapproved 2013).
- B. ASTM A603 - Standard Specification for Zinc-Coated Steel Structural Wire Rope; 1998 (Reapproved 2014).
- C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2021.
- D. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.
- E. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.
- C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
  - 1. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 1 to 4 inch wg.
- D. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.



- E. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.
- F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.
- G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

### **1.5. QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

### **1.6. WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

## **PART 2 PRODUCTS**

### **2.1. MANUFACTURED UNITS**

- A. Ceiling mounted variable air volume supply air control terminals for connection to single duct, central air systems, with digital / electric variable volume controls, electric heating coils.
- B. Identify each terminal unit with clearly marked identification label and air flow indicator. Include unit nominal air flow, maximum factory set airflow, minimum factory set air flow, and coil type.

### **2.2. SINGLE DUCT VARIABLE VOLUME UNITS**

- A. Manufacturers:
  - 1. Carnes; Model Series AV: [www.carnes.com](http://www.carnes.com).
  - 2. Price; Model Series S-V: [www.price-hvac.com](http://www.price-hvac.com).
  - 3. Titus; Model Series ESV: [www.titus-hvac.com](http://www.titus-hvac.com).
  - 4. Nailor; Model 3000 Series: [www.nailor.com](http://www.nailor.com).
  - 5. Metalaire; Model Series TH: [www.metalair.com](http://www.metalair.com).
  - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Basic Assembly:
  - 1. Casings: Minimum 22 gage galvanized steel.
  - 2. Lining: Minimum 3/4 inch thick neoprene or vinyl coated fibrous glass insulation, 1.5 lb/cu ft density, meeting NFPA 90A requirements and UL 181 erosion requirements.

**AIR TERMINAL UNITS**

3. Plenum Air Inlets: Round stub connections for duct attachment.
4. Plenum Air Outlets: S slip and drive connections.
- C. Basic Unit:
  1. Configuration: Air volume damper assembly inside unit casing. Locate control components inside protective metal shroud.
  2. Volume Damper: Construct of galvanized steel with peripheral gasket and self lubricating bearings; maximum damper leakage: 2 percent of design air flow at 3 inches inlet static pressure.
  3. Mount damper operator to position damper normally open.
- D. Attenuator Section: Line attenuator sections with 2 inch thick insulation.
- E. Multi Outlet Attenuator Section: With 8 inch diameter collars, each with butterfly balancing damper with lock.
- F. Round Outlet: Discharge collar matching inlet size.
- G. Electric Heating Coil:
  1. Construction: UL listed, slip-in type, open coil design, integral control box factory wired and installed, with:
    - a. Primary and secondary over-temperature protection.
    - b. Minimum airflow switch.
    - c. Magnetic contactor for each step of control.
  2. Electrical Characteristics:
    - a. Refer to Division 26.
- H. Automatic Damper Operator:
  1. Electric Actuator: 24 volt with remote temperature read and reset capability.
- I. Thermostat: Refer to Section 23 0913.

**PART 3 EXECUTION****3.1. INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.
- C. Provide ceiling access doors or locate units above easily removable ceiling components.
- D. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM). See Section 23 05 48.
- E. Do not support from ductwork.
- F. Connect to ductwork in accordance with Section 23 31 00.
- G. Provide minimum of 5 ft of 1 inch thick lined ductwork downstream of units.
- H. Verify that electric power is available and of the correct characteristics.

**3.2. ADJUSTING**

- A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to zero percent full flow. Set units with heating coils for minimum 50 percent full flow.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

**1.2. RELATED REQUIREMENTS**

- A. Section 09 91 23 - Interior Painting: Painting of ducts visible behind outlets and inlets.

**1.3. REFERENCE STANDARDS**

- A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2015.
- B. ARI 890 - Standard for Air Diffusers and Air Diffuser Assemblies; Air-Conditioning and Refrigeration Institute; 2008.
- C. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; 2006 (Reaffirmed 2011).

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
- C. Project Record Documents: Record actual locations of air outlets and inlets.

**1.5. QUALITY ASSURANCE**

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. Test and rate louver performance in accordance with AMCA 500-L.

**1.6. QUALITY ASSURANCE**

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

**PART 2 PRODUCTS (ON THE DRAWINGS)**

**2.1. MANUFACTURERS**

- A. Carnes, a division of Carnes Company Inc.: [www.carnes.com](http://www.carnes.com).
- B. Krueger: [www.krueger-hvac.com](http://www.krueger-hvac.com).
- C. Price Industries: [www.price-hvac.com](http://www.price-hvac.com).
- D. Titus: [www.titus-hvac.com](http://www.titus-hvac.com).
- E. Nailor; [www.nailor.com](http://www.nailor.com).
- F. Metalaire [www.metalaire.com](http://www.metalaire.com)
- G. Shoemaker; [www.shoemakermfg.com](http://www.shoemakermfg.com).
- H. Substitutions: See Section 01 60 00 - Product Requirements.

**PART 3 EXECUTION**

**3.1. INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 91 23.

**END OF SECTION**

**PACKAGED OUTDOOR ROOFTOP UNITS - SMALL CAPACITY****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Packaged roof top unit.
- B. Roof mounting curb.

**1.2. RELATED REQUIREMENTS**

- A. Section 23 05 48 - Vibration Isolation and Sound and Seismic Controls for HVAC Piping and Equipment.
- B. Section 23 05 49 - HVAC Seismic Restraint.
- C. Section 23 09 13 - Instrumentation and Control Devices for HVAC.
- D. Section 23 09 93 - Sequence of Operations for HVAC Controls.
- E. Section 23 33 00 - Air Duct Accessories.
- F. Division 26: Electrical characteristics and wiring connections.

**1.3. REFERENCE STANDARDS**

- A. ANSI/AMCA Standard 500-D-07, "Laboratory Methods of Testing Dampers for Rating"; 2007.
- B. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; American Society for Testing and Materials.
- C. NFPA 54 - National Fuel Gas Code; National Fire Protection Association.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.
- C. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.
- D. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.
- E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Filters: One set for each unit.
  - 3. Fan Belts: One set for each unit.

**PACKAGED OUTDOOR ROOFTOP UNITS - SMALL CAPACITY****1.5. QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum 10 years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

**1.6. DELIVERY, STORAGE, AND HANDLING**

- A. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

**1.7. WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide a five year warranty to include coverage for refrigeration compressors and heat exchangers.

**PART 2 PRODUCTS****2.1. ROOFTOP AIR CONDITIONING UNITS**

- A. Manufacturers:
  - 1. Daikin Applied.
  - 2. Aeon Incorporated.
  - 3. Carrier Corp.
  - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Product Description: Self-contained, packaged, factory assembled and wired, consisting of roof curb, cabinet, supply fan, refrigerant cooling coil, compressor, refrigeration circuit, condenser, gas-fired heating section, electric or hot water heating coil, air filters, mixed air casing, controls, and accessories.
- C. Configuration: As indicated on Drawings.
- D. Roof Mounting Curb: 14 inch high, galvanized steel, channel frame with gaskets, nailer strips. Full perimeter type for mounting under entire unit.
- E. Cabinet:
  - 1. Designed for outdoor installation with weatherproof construction.
  - 2. Panels: Constructed of galvanized steel with baked enamel finish meeting salt spray test in accordance with ASTM B117. Furnish access doors or removable access panels.
  - 3. Insulation: Factory applied to exposed vertical and horizontal panels, 1/2-inch thick aluminum foil faced foam or glass fiber with edges protected from erosion.
- F. Supply Fan: Forward curved centrifugal type, resiliently mounted with direct drive (under 3 tons) and V-belt drive or adjustable variable pitch motor pulley (3 tons and over) and high efficiency motor. Motor permanently lubricated with built-in thermal overload protection.

**PACKAGED OUTDOOR ROOFTOP UNITS - SMALL CAPACITY**

- G. Evaporator Coil: Constructed of copper tubes expanded onto aluminum fins. Galvanized drain pan with piping connection. Factory leak tested under water.
- H. Compressor: Hermetically sealed, resiliently mounted with positive lubrication, and internal motor overload protection. Furnish vibration isolators and short cycle protection.
- I. Refrigeration circuit: Furnish the following for each circuit: fixed orifice control (under 3 tons) or thermal expansion valve (3 tons and over), filter-drier, suction, discharge, and liquid line service valves with gauge ports, high and low pressure safety controls. Dehydrate and factory charge each circuit with oil and refrigerant.
- J. Condenser:
  - 1. Coil: Copper tube with aluminum or copper fin coil assembly. Factory leak tested under water.
  - 2. Condenser Fan: Direct drive propeller fans statically and dynamically balanced. Wired to operate with compressor. Motor permanently lubricated with built-in thermal overload protection. Furnish high efficiency fan motors.
- K. Gas-Fired Heating Section:
  - 1. Fuel: Natural gas.
  - 2. Heat Exchangers: Stainless steel.
  - 3. Gas Burner: Induced draft type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition and flame sensing device. Require unit fan operation before allowing gas valve to open.
- L. Air Filters: 2 thick glass fiber disposable media in metal frames. 30 percent efficiency based on ASHRAE 52 (MERV 8 based on ASHRAE 52.2).
- M. Mixed Air Casing:
  - 1. Damper Leakage: Furnish Class I motorized dampers with maximum leakage rate of 4 cfm per square foot at 1-inch water column pressure differential when tested in accordance with AMCA 500D.
  - 2. Economizer: Factory installed fully modulating motorized outside air and return air dampers controlled by dry bulb or enthalpy controller with minimum position setting. Outside air damper normally closed and return air damper normally open. Furnish barometric relief damper capable of closing by gravity (3 tons and under) and barometric relief damper with powered exhaust (above 3 tons). Furnish rain hood with screen.
- N. Controls:
  - 1. Terminal strip for field mounted controls.
- O. Accessories:
  - 1. Convenience Outlet: Factory installed, 115 volt, 15 amp, GFCI type, internally mounted.
- P. Capacity:
  - 1. Refer to Drawing schedules.

**2.2. ELECTRICAL CHARACTERISTICS AND COMPONENTS**

- A. Electrical Characteristics: In accordance with Division 26.



**PACKAGED OUTDOOR ROOFTOP UNITS - SMALL CAPACITY**

- B. Disconnect Switch: Factory mounted, non-fused type, interlocked with access door, accessible from outside unit, with power lockout capability.

**PART 3 EXECUTION****3.1. EXAMINATION**

- A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Verify that proper power supply is available.

**3.2. INSTALLATION**

- A. Roof Curb:
  - 1. Assemble roof curb.
  - 2. Install roof curb level.
  - 3. Coordinate curb installation and flashing with Architect.
  - 4. Install units on roof curb providing watertight enclosure to protect ductwork and utility services.
  - 5. Install gasket material between unit base and roof curb.
- B. Install units on vibration isolators. Refer to Section 23 05 48.
- C. Connect units to supply and return ductwork with flexible connections. Refer to Section 23 33 00.
- D. Install condensate piping with trap and route from drain pan to splash block on roof.
- E. Install components furnished loose for field mounting.
- F. Install electrical devices furnished loose for field mounting.
- G. Install control wiring between unit and field installed accessories.
- H. Remove from roof and dispose off-site panels removed from units during installation of economizer and dampers.
- I. Locate remote panels as indicated on Drawings.
- J. Provide fixed sheaves required for final air balance.

**3.3. INSTALLATION - NATURAL GAS HEATING SECTION**

- A. Connect natural gas piping in accordance with NFPA 54.
- B. Connect natural gas piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.
- C. Install the following piping accessories on natural gas piping connections. Refer to Section 23 11 13.
  - 1. Strainer.
  - 2. Pressure gage.
  - 3. Shutoff valve.
  - 4. Pressure reducing valve.
- D. Install natural gas piping accessories above roof, within unit casing, or below roof.

**PACKAGED OUTDOOR ROOFTOP UNITS - SMALL CAPACITY****3.4. CLEANING**

- A. Section 01 70 00 - Execution Requirements: Requirements for cleaning.
- B. Vacuum clean coils and inside of unit cabinet.
- C. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

**3.5. DEMONSTRATION**

- A. Section 01 7000 - Execution Requirements: Requirements for demonstration and training.
- B. Demonstrate unit operation and maintenance.
- C. Furnish services of manufacturer's technical representative for one 8 hour day to instruct Owner's personnel in operation and maintenance of units. Schedule training with Owner, provide at least 7 days notice to Architect/Engineer of training date.

**END OF SECTION**

**PACKAGED OUTDOOR CENTRAL-STATION ROOFTOP UNITS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Packaged roof top unit.
- B. Unit controls.

**1.2. RELATED REQUIREMENTS**

- A. Section 23 05 48 - Vibration Isolation and Sound and Seismic Controls for HVAC Piping and Equipment.
- B. Section 23 0549 - HVAC Seismic Restraint.
- C. Section 23 09 13 - Instrumentation and Control Devices for HVAC.
- D. Section 23 0993 - Sequence of Operations for HVAC Controls.
- E. Section 23 3300 - Air Duct Accessories.
- F. Division 26: Electrical characteristics and wiring connections.

**1.3. REFERENCE STANDARDS**

- A. ANSI/AMCA Standard 500-D-07, "Laboratory Methods of Testing Dampers for Rating"; 2007.
- B. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; American Society for Testing and Materials.
- C. NFPA 54 - National Fuel Gas Code; National Fire Protection Association.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.
- C. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.
- D. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.
- E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Filters: One set for each unit.
  - 3. Fan Belts: One set for each unit.

**PACKAGED OUTDOOR CENTRAL-STATION ROOFTOP UNITS****1.5. QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum 10 years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

**1.6. DELIVERY, STORAGE, AND HANDLING**

- A. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

**1.7. WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide a five year warranty to include coverage for refrigeration compressors and heat exchangers.

**PART 2 PRODUCTS****2.1. MANUFACTURERS**

- A. Daikin Applied.
- B. Aeon Model Series : [www.aeon.com](http://www.aeon.com).
- C. Substitutions: See Section 01 60 00 - Product Requirements.

**2.2. MANUFACTURED UNITS**

- A. General: Roof mounted units having gas burner and electric refrigeration.
- B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, return fan, variable frequency drives prewired, heat exchanger and burner, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.
- C. Electrical Characteristics:
  - 1. Refer to Division 26.
- D. Disconnect Switch: Factory mounted, non-fused type, interlocked with access door, accessible from outside unit, with power lockout capability.

**2.3. FABRICATION**

- A. Cabinet: Galvanized steel with baked enamel finish, including access panels with screwdriver operated flush cam type fasteners. Structural members shall be minimum 18 gage, with access doors or panels of minimum 20 gage.
- B. Insulation: 2 inch thick neoprene coated glass fiber with edges protected from erosion.
- C. Heat Exchangers: Aluminized steel, of welded construction.

**PACKAGED OUTDOOR CENTRAL-STATION ROOFTOP UNITS**

- D. Supply and Return Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, adjustable variable pitch motor pulley, and rubber isolated hinge mounted high efficiency motor or direct drive as indicated. Refer to Section 23 05 48.
- E. Supply Fan Modulation:
  - 1. Controlled from duct static pressure by unit mounted controller. Static pressure sensed by duct mounted sensor.
  - 2. Furnish field adjustable duct high limit safety control to protect duct work from excessive duct pressure.
- F. Air Filters: 2 inch thick glass fiber disposable media in metal frames.
  - 1. Filter Section:
    - a. Location: Upstream of fan section.
    - b. Furnish section with integral galvanized steel filter staggered rack contained within unit.
    - c. Disposable filters: Frame mounted 2 inch thick 30 percent efficient based on ASHRAE 52.
    - d. Cartridge filters: 12 inch deep, 90 to 95 percent efficient, based on ASHRAE 52. Furnish with 2 inch thick pre-filters.
  - 2. Final Filter Section:
    - a. Location: Downstream of supply fan and coils.
    - b. Cartridge Filters: 12 inch deep, 90 to 95 percent efficient, based on ASHRAE 52. Furnish with 2 inch thick pre-filters.
    - c. Bag Filters: 90 percent average efficiency based on ASHRAE 52. Rated for 500 degrees F. Furnish 2 inch thick pre-filters.
- G. Vibration Isolation Curb: 23 05 48.

**2.4. BURNER**

- A. Gas Burner: Atmospheric type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shut-off pilot.
- B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after air flow proven and slight delay, allow gas valve to open.
- C. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.
- D. Supply Fan Control: Temperature sensor sensing bonnet temperatures and independent of burner controls, with provisions for continuous fan operation.

**2.5. EVAPORATOR COIL**

- A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.

**PACKAGED OUTDOOR CENTRAL-STATION ROOFTOP UNITS**

- B. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

**2.6. COMPRESSOR**

- A. Provide inverter compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.
- B. Five minute timed off circuit to delay compressor start.
- C. Outdoor thermostat to energize compressor above 35 degrees F ambient.
- D. Provide step capacity control by hot gas by-pass.

**2.7. CONDENSER COIL**

- A. Provide copper tube aluminum fin coil assembly with subcooling rows and coil guard.
- B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Provide high efficiency fan motors.
- C. Provide refrigerant pressure switches to cycle condenser fans.
- D. Refrigeration circuit:
  - 1. Dehydrate and factory charge each circuit with oil and refrigerant.
  - 2. Furnish the following for each circuit:
    - a. Thermal expansion device.
    - b. Filter-drier.
    - c. Replaceable core filter drier.
    - d. Suction, discharge, and liquid line service valves with gauge ports.
    - e. Sight glass.
    - f. High and low pressure safety controls.
    - g. Liquid line solenoid valve.
    - h. Sub-cooler circuit to provide 15 degrees of liquid sub-cooling.
  - 3. Capacity control:
    - a. By cycling compressors.
    - b. Hot gas bypass: Factory installed on each refrigerant circuit including hot gas bypass valve, solenoid valve and hot gas bypass piping.
  - 4. Furnish control to provide low ambient cooling to 0 degrees F.

**2.8. MIXED AIR CASING**

- A. Mixed Air Controls: Maintain selected supply air temperature and return dampers to minimum position on call for heating and above 75 degrees F ambient, or when ambient air temperature exceeds return air temperature.

**2.9. OPERATING CONTROLS**

- A. Terminal strip for field mounted controls.

**PACKAGED OUTDOOR CENTRAL-STATION ROOFTOP UNITS****PART 3 EXECUTION****3.1. EXAMINATION**

- A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Verify that proper power supply is available.

**3.2. INSTALLATION**

- A. Roof Curb:
  - 1. Assemble roof curb.
  - 2. Install roof curb level.
  - 3. Coordinate curb installation and flashing with Architect.
  - 4. Install units on roof curb providing watertight enclosure to protect ductwork and utility services.
  - 5. Install gasket material between unit base and roof curb.
- B. Install units on vibration isolators. Refer to Section 23 0548.
- C. Connect units to supply and return ductwork with flexible connections. Refer to Section 23 33 00.
- D. Install condensate piping with trap and route from drain pan to splash block on roof.
- E. Install components furnished loose for field mounting.
- F. Install electrical devices furnished loose for field mounting.
- G. Install control wiring between unit and field installed accessories.
- H. Remove from roof and dispose off-site panels removed from units during installation of economizer and dampers.
- I. Locate remote panels as indicated on Drawings.
- J. Provide fixed sheaves required for final air balance.

**3.3. CLEANING**

- A. Section 01 70 00 - Execution Requirements: Requirements for cleaning.
- B. Vacuum clean coils and inside of unit cabinet.
- C. Install temporary filters during construction period. Replace with permanent filters at Substantial Completion.

**3.4. DEMONSTRATION**

- A. Section 01 70 00 - Execution Requirements: Requirements for demonstration and training.
- B. Demonstrate unit operation and maintenance.
- C. Furnish services of manufacturer's technical representative for one 8 hour day to instruct Owner's personnel in operation and maintenance of units. Schedule training with Owner, provide at least 7 days notice to Architect/Engineer of training date.

**END OF SECTION**

**PACKAGED OUTDOOR CENTRAL-STATION ROOFTOP UNITS**



**CUSTOM OUTDOOR CENTRAL-STATION AIR HANDLING UNITS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Custom air handling units.
- B. Roof curbs.

**1.2. RELATED REQUIREMENTS**

- A. Section 23 05 49 - HVAC Seismic Restraint.
- B. Section 23 05 48 - Vibration Isolation and Sound and Seismic Controls for HVAC Piping and Equipment.
- C. Section 23 05 57 - HVAC Variable Frequency Controllers
- D. Section 23 09 13 - Instrumentation and Control Devices for HVAC.
- E. Section 23 09 93 - Sequence of Operation for HVAC Controls.
- F. Division 26: Electrical characteristics and wiring connections.

**1.3. REFERENCE STANDARDS**

- A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.; 1990 (Reapproved 2008).
- B. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings; American Bearing Manufacturers Association, Inc.; 1990 (Reapproved 1999).
- C. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 2010.
- D. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 2007 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).
- E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2008.
- F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.; 2006.
- G. AHRI 410 - Standard for Forced-Circulation Air-Cooling and Air-Heating Coils; Air-Conditioning, Heating, and Refrigeration Institute; 2001 (R2002) .
- H. AHRI 430 - Standard for Central-Station Air-Handling Units; Air-Conditioning, Heating, and Refrigeration Institute; 2009.
- I. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.
- J. UL 900 - Standard for Air Filter Units; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data:
  - 1. Published Literature: Indicate dimensions, weights, capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.

**CUSTOM OUTDOOR CENTRAL-STATION AIR HANDLING UNITS**

2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
  3. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
  4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
  5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
- C. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
- D. Manufacturer's Instructions: Include installation instructions.
- E. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Extra Fan Belts: Two sets for each unit.
  3. Extra Filters: Two sets for each unit.

**1.5. QUALITY ASSURANCE**

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

**1.6. REGULATORY REQUIREMENTS**

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

**1.7. DELIVERY, STORAGE, AND HANDLING**

- A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.
- B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.
- C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

**PART 2 PRODUCTS****2.1. MANUFACTURERS**

- A. Innovative Air Technologies.
- B. Substitutions: See Section 01 60 00 - Product Requirements.

**CUSTOM OUTDOOR CENTRAL-STATION AIR HANDLING UNITS****2.2. GENERAL DESCRIPTION**

- A. Configuration: Fabricate with fan and coil section plus accessories, including:
  - 1. Cooling coil section.
  - 2. Heating coil.
  - 3. Filter section.
  - 4. Desiccant Dehumidification and React Section.
- B. Fabrication: Conform to AMCA 99 and AHRI 430.
- C. Performance: Sea level conditions.

**PART 3 EXECUTION****3.1. INSTALLATION**

- A. Install in accordance with AHRI 430.
- B. Install flexible duct connections between fan inlet and discharge ductwork and air handling unit sections. Ensure that metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- C. Install assembled unit on vibration isolators. Install isolated fans with resilient mountings and flexible electrical leads. Install restraining snubbers as indicated. Refer to Section 23 05 48. Adjust snubbers to prevent tension in flexible connectors when fan is operating.
- D. Provide fixed sheaves required for final air balance.

**END OF SECTION**

**SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Air-source heat pumps.
- B. Indoor ductless fan coil units.
- C. Outdoor VRF heat pumps.
- D. Refrigerant piping.
- E. Refrigerant Piping Insulation.
- F. Controls.

**1.2. RELATED REQUIREMENTS**

- A. Section 22 10 05 - Plumbing Piping : Includes indoor coil condensate drain, water supply for humidifier, natural gas piping, and \_\_\_\_\_.
- B. Section 22 30 00 - Plumbing Equipment: Cooling condensate removal pumps.
- C. Section 23 09 13 - Instrumentation and Control Devices for HVAC: Thermostats, humidistats, time clocks.
- D. Section 23 31 00 - HVAC Ducts and Casings.
- E. Division 26: Electrical characteristics and wiring connections and installation and wiring of thermostats and other controls components.

**1.3. REFERENCE STANDARDS**

- A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008, Including All Addenda.
- B. AHRI 270 - Sound Performance Rating of Outdoor Unitary Equipment; 2015.
- C. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.
- D. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.
- E. ASHRAE Std 23.1 - Methods of Testing for Rating the Performance of Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Temperatures of the Refrigerant; 2010.
- F. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017.
- G. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2021.
- I. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2018.
- J. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

**SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS**

- B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
- D. Design Data: Indicate refrigerant pipe sizing.
- E. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
- F. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.
- G. Project Record Documents: Record actual locations of components and connections.
- H. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- I. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- J. Project Record Documents: Record actual locations of components and connections.
- K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

**1.5. QUALITY ASSURANCE**

- A. Units shall be listed by ETL (Engineering Testing Laboratory) and be evaluated in accordance with UL standard 1995, 4th. edition.
- B. Units shall be listed in the AHRI directory.
- C. All units shall meet the Federal minimum efficiency standards and be tested per AHRI 210/240 Standard.
- D. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of documented experience .

**1.6. DELIVERY, STORAGE, AND HANDLING**

- A. Units shall be shipped in one piece and shall be stored and handled per unit manufacturer's recommendations.

**1.7. WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturers warranty for heat exchangers, condensing units, and compressors.

**PART 2 PRODUCTS****2.1. MANUFACTURERS**

- A. Carrier Corporation: [www.carrier.com](http://www.carrier.com).
- B. Trane Inc.: [www.trane.com](http://www.trane.com).

**SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS**

- C. York International Corporation / Johnson Controls: [www.york.com](http://www.york.com).
- D. Substitutions: See Section 01 60 00 - Product Requirements.

**2.2. SYSTEM DESIGN**

- A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
  - 1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator; indoors.
- B. Performance Requirements: See Drawings for additional requirements.
- C. Electrical Characteristics:
  - 1. Refer to Mechanical Equipment Schedules and Electrical Drawings.
  - 2. Disconnect Switch: Factory mount disconnect switch on equipment under provisions of Section 26 27 17.

**2.3. HIGHWALL INDOOR UNITS FOR DUCTLESS SYSTEMS**

- A. Manufacturer:
  - 1. Carrier/Toshiba.
  - 2. Daikin: [www.daikin.com](http://www.daikin.com).
  - 3. LG: [www.lghvac.com](http://www.lghvac.com)
  - 4. Mitsubishi Electric: [www.mrslim.com](http://www.mrslim.com).
- B. Indoor Units:
  - 1. The indoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. Both liquid and suction lines must be individually insulated between the outdoor and indoor units.
  - 2. Unit Cabinet:
    - a. The indoor unit shall have a white, "flat screen" finish.
    - b. The drain and refrigerant piping shall be accessible from six (6) positions for flexible installation (right side, right back, and right bottom; and left side, left back, and left bottom).
    - c. The cabinet shall be supplied with a mounting plate to be installed onto a wall for securely mounting the cabinet.
    - d. Provide with zero-position EEV for systems with variable flow/multiple indoor units.
  - 3. Fan:
    - a. The evaporator fan shall be an assembly consisting of a direct-driven fan by a single motor.
    - b. The fan shall be statically and dynamically balanced and operate on a motor with permanent lubricated bearings.
  - 4. Filter:
    - a. The return air filter provided will be a mildew proof, removable and washable filter. Titanium apatite, photocatalytic air purifying filters are included as standard.
  - 5. Coil:

**SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS**

- a. The evaporator coil shall be a nonferrous, aluminum fin on copper tube heat exchanger.
  - b. All tube joints shall be brazed with silver alloy or phoscopper.
  - c. All coils will be factory pressure tested.
  - d. A condensate pan shall be provided under the coil with a drain connection.
- 6. Electrical:
  - a. The outdoor unit shall be powered with 208-230 volts, 1 phase, and 60 hertz power. The indoor unit shall receive 208-230 volt, 1 phase, 60 hertz power from the outdoor unit.
- 7. Control:
  - a. The unit shall have a backlit, wired controller. 7-day programmable with auto change over, independent heating and cooling setpoints.
- 8. Accessories: Condensate pump.
- C. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.
- D. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
  - 1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
  - 2. Manufacturer: System manufacturer.
- E. Remote Actuators:

**2.4. OUTDOOR UNITS - HEAT PUMPS (INVERTER DRIVEN)**

- A. Manufacturers:
  - 1. Daikin; Model RXTG: [www.daikin.com](http://www.daikin.com).
  - 2. Mitsubishi Electric: [www.mrslim.com](http://www.mrslim.com).
  - 3. LG: [www.lghvac.com](http://www.lghvac.com).
- B. The outdoor unit shall be specifically matched to the corresponding indoor unit size. The outdoor unit shall be complete factory assembled and pre-wired with all necessary electronic and refrigerant controls.
  - 1. Comply with AHRI 210 and AHRI 520.
    - a. Refrigerant: R-410A
    - b. Construction and ratings: In accordance with AHRI 210/240 with testing is accordance with ASHRAE Std 23 and UL 207 listed
    - c. Sound ratings as scheduled when measured in accordance with AHRI 270.
- C. Unit Cabinet:
  - 1. The outdoor unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.
- D. Fan:
  - 1. The fan shall be a direct drive, propeller type fan.
    - a. The motor shall be inverter driven, permanently lubricated type bearings, inherent.

**SMALL CAPACITY SPLIT-SYSTEM AIR CONDITIONERS**

- b. A fan guard is provided on the outdoor unit to prevent contact with fan operation.
    - c. Airflow shall be horizontal discharge.
- E. Coil:
  - 1. The outdoor coil shall be nonferrous construction with corrugated fin tube.
    - a. Refrigerant flow from the condenser will be controlled via a metering device.
- F. Compressor:
  - 1. The compressor shall be a variable speed inverter driven scroll compressor.
    - a. The outdoor unit shall have an accumulator.
    - b. The compressor shall have an internal thermal overload.
    - c. Comply with AHRI 520.
    - d. Spring mounted.
- G. Electrical:
  - 1. The electrical power requirement is 208-230 volt, 1-phase, and 60 Hz power.
    - a. The outdoor shall be controlled by a microprocessor located in the outdoor and indoor units via commands from the infrared remote controller.
- H. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig and off when pressure drops below 140 psig for operation to 0 degrees F.

**2.5. SYSTEM REFRIGERANT PIPING**

- A. Refrigerant Piping:
  - 1. Copper Tube: ASTM B 280, Type ACR.
  - 2. Wrought-Copper Fittings: ASME B16.22.
  - 3. Brazing Filler Metals: AWS A5.8/A5.8M.
  - 4. Insulation: Insulate both heat pump refrigerant lines. Insulate all three refrigerant lines from heat recovery outdoor units to MCU.
- B. Refrigerant Tubing Kits:
  - 1. Factory-rolled and -bundled, soft-copper tubing with tubing termination fittings at each end.
  - 2. Modular systems require outdoor refrigerant kits for module connections.
  - 3. Standard one-piece length for connecting to indoor units.
  - 4. Pre-insulated with flexible elastomeric insulation of thickness to comply with governing energy code and sufficient to eliminate condensation.
  - 5. Factory Charge: Dehydrated air or nitrogen.
- C. Refrigerant Isolation Ball Valves:
  - 1. Description: Uni-body full port design, rated for maximum system temperature and pressure, and factory tested under pressure to ensure tight shutoff. Designed for valve operation without removing seal cap.
  - 2. Seals: Compatible with system refrigerant and oil. Seal service life of at least 20 years.
  - 3. Valve Connections: Flare or sweat depending on size.



**2.6. PIPING AND TUBING INSULATION**

- A. Condensate Drain Piping and Tubing Insulation and Jacket Requirements:
  - 1. Flexible Elastomeric Insulation:
    - a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C 534, Type I for tubular materials.
    - b. Thickness: Per Code.
- B. Refrigerant Tubing Insulation and Jacket Requirements:
  - 1. Flexible Elastomeric Insulation:
    - a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C 534, Type I for tubular materials.
    - b. Thickness: Per Code.

**PART 3 EXECUTION**

**3.1. EXAMINATION**

- A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.
- B. Verify that proper power supply is available and in correct location.

**3.2. INSTALLATION**

- A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.
- B. Install in accordance with NFPA 90A and NFPA 90B.
- C. Install refrigeration systems in accordance with ASHRAE Std 15.
- D. Pipe drain from cooling coils and humidifiers to hub drain per drawings.
- E. Consult with roofing manufacturer prior to installation of equipment base. Provide roofing material or rubber pads to protect roof as required by roofing manufacturers/

**END OF SECTION**

**HUMIDIFIERS****<<<< UPDATE NOTES****PART 1 GENERAL****2.1. SECTION INCLUDES**

- A. Humidifier Units.
- B. Spray Pumps.

**2.2. RELATED REQUIREMENTS**

- A. Section 22 07 19 - Plumbing Piping Insulation.
- B. Section 23 07 13 - Duct Insulation.
- C. Section 23 07 19 - HVAC Piping Insulation.
- D. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

**2.3. REFERENCE STANDARDS**

- A. AHRI 610 (I-P) - Performance Rating Of Central System Humidifiers for Residential Applications; 2014.
- B. AHRI 611 (SI) - Performance Rating Of Central System Humidifiers for Residential Applications; 2014.
- C. UL 900 - Standard for Air Filter Units; Current Edition, Including All Revisions.

**2.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog sheets indicating general assembly, dimensions, weights, materials, and certified performance ratings.
- C. Shop Drawings: Indicate general assembly, dimensions, weights, and materials.
- D. Manufacturer's Instructions: Indicate recommended installation instructions.
- E. Manufacturer's Instructions: Indicate recommended installation instructions.
- F. Operation Data: Include assembly instructions, float adjustment, bleed rates, and electrical requirements.
- G. Maintenance Data: Include instructions for lubrication, filter replacement, cleaning, and spare parts lists.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Filter Media: One set of each type and size.

**2.5. QUALITY ASSURANCE**

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

**HUMIDIFIERS**

- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

**2.6. WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for units.

**PART 2 PRODUCTS****3.1. MANUFACTURERS**

- A. Cendair.
- B. Substitutions: See Section 01 60 00 - Product Requirements.

**3.2. MANUFACTURED UNITS**

- A. Units: AHRI 610 (I-P); factory assembled consisting of casing, tank, filters, spray pumps, water and drain connections.

**3.3. CASING**

- A. Assembly: Galvanized steel, minimum 0.0635 inch thick, reinforced and braced with galvanized steel angles and corrosion resistant cap screws.
- B. Connection: 1-1/2 inch flanges on inlet and outlet with 1/4 by 1 inch adhesive backed neoprene gasket.
- C. Doors: 20 by 36 inch quick opening access door on one side with 1/4 inch thick acrylic sheet inspection window.
- D. Finish: Two coats of zinc chromate, iron oxide, or phenolic resin paint applied after assembly.
- E. Gasket and flange pipe penetrations, inspection panels, access doors, and other openings in casing.

**3.4. DRAIN TANK**

- A. Tank: Welded black steel 4 inches deep, 0.1345 inch thick, finished inside and out with zinc chromate, iron oxide phenolic resin paint and coated inside with asphalt coating.
- B. Connections: 3/4 inch adjustable float valve assembly with brass rod and brass float; 2 inch drain and overflow with removable copper suction screen.
- C. Fabricate: Lap and weld corners watertight. Weld fittings and piping supports to tank.

**3.5. FILTERS**

- A. Filters: Two rows of neoprene coated filter mats in removable frames.
- B. Piping: 1-1/2 inch PVC.

**HUMIDIFIERS****3.6. PUMPS**

- A. Spray Assembly: Moisture resistant motor with built-in overload protection, brass impeller and cut-off blade, in galvanized well.
- B. Spray Pump: Refer to Section 23 21 23.

**PART 3 EXECUTION****4.1. INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Insulate exterior of unit same as specified for ductwork. Refer to Section 23 07 13.
- C. Place unit on 2 inch thick rigid insulation board same size as unit tank. Flash and counterflash with 0.036 inch galvanized steel entering and leaving sides. Refer to Section 23 07 13.
- D. Connect unit to water supply. Provide gate valve on water supply line. Provide 3/4 inch hose bibb accessible from interior.
- E. Pipe drain and overflow to nearest floor drain.
- F. Bolt spray pump directly to tank fitting. Insulate external spray piping. Refer to Section 22 07 19.
- G. Bolt spray pump directly to tank fitting. Insulate external spray piping. Refer to Section 23 07 19.
- H. Provide globe valve and solenoid valve in 1/2 inch bleed line from drain. Refer to Section 23 25 00.
- I. Provide low water cut-off in drain pan to stop spray pump.

**END OF SECTION**



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# OMIC ADDITIVE MANUFACTURING CENTER

## Scappoose, OR

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**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.

**1.2. RELATED REQUIREMENTS**

- A. Section 26 05 19 - Low Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

**1.3. REFERENCE STANDARDS**

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2007.
- D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 99 - Health Care Facilities Code; 2015.
- G. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

**1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Verify exact locations of underground metal water service pipe entrances to building.
  - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
  - 3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS****1.5. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system connectors.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Field quality control test reports.
- E. Project Record Documents: Record actual locations of grounding electrode system components and connections.

**1.6. QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

**1.7. DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

**PART 2 PRODUCTS****2.1. GROUNDING AND BONDING REQUIREMENTS**

- A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.
- B. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- E. Grounding System Resistance:
  - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
  - 2. Grounding Electrode System: Not greater than 5 ohms OR 25 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.

**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested according to IEEE 81 using "point-to-point" methods.
- F. Grounding Electrode System:
1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
    - a. Provide continuous grounding electrode conductors without splice or joint.
    - b. Install grounding electrode conductors in non-metallic raceway where exposed to physical damage.
  2. Metal Underground Water Pipe(s):
    - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
    - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
    - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
  3. Metal Building or Structure Frame:
    - a. Provide connection to metal building or structure frame effectively grounded in accordance with NFPA 70 at nearest accessible location.
  4. Concrete-Encased Electrode:
    - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
  5. Ground Ring:
    - a. Provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.
    - b. Where location is not indicated, locate ground ring conductor at least 24 inches outside building perimeter foundation.
    - c. Provide connection from ground ring conductor to:
      1. Perimeter columns of metal building frame.
      2. Ground rod electrodes located as indicated, not more than 30 feet apart, and at each corner of the building/structure.
  6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
  7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
    - a. Ground Bar Size: 1/4 by 4 by 12 inches unless otherwise indicated or required.



**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

- b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
    - c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
  - 8. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.
- G. Service-Supplied System Grounding:
  - 1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
  - 2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- H. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
  - 1. Provide grounding electrode system for each separate building or structure.
  - 2. Provide equipment grounding conductor routed with supply conductors.
  - 3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
  - 4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.
- I. Separately Derived System Grounding:
  - 1. Separately derived systems include, but are not limited to:
    - a. Transformers (except autotransformers such as buck-boost transformers).
    - b. Uninterruptible power supplies (UPS), when configured as separately derived systems.
    - c. Generators, when neutral is switched in the transfer switch.
  - 2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame OR nearest effectively grounded metal water pipe OR common grounding electrode conductor ground riser. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure OR neutral (grounded) bus in first disconnecting means.
  - 3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
  - 4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.

**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

5. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
  6. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
  7. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
- J. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
  2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
  3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
  4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
  5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
  6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
  7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
    - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
    - b. Metal gas piping.
    - c. Metal process piping.
  8. Provide bonding for interior metal air ducts.
  9. Provide bonding for metal building frame where not used as a grounding electrode.
  10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
  11. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.
  12. Provide redundant grounding and bonding for patient care areas of health care facilities in accordance with NFPA 70 and NFPA 99.
- K. Isolated Ground System:
1. Where isolated ground receptacles or other isolated ground connections are indicated, provide separate isolated/insulated equipment grounding conductors.

**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

2. Connect isolated/insulated equipment grounding conductors only to separate isolated/insulated equipment ground busses.
  3. Connect the isolated/insulated equipment grounding conductors to the solidly bonded equipment ground bus only at the service disconnect or separately derived system disconnect. Do not make any other connections between isolated ground system and normal equipment ground system on the load side of this connection.
- L. Photovoltaic Systems.

**2.2. GROUNDING AND BONDING COMPONENTS**

- A. General Requirements:
1. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
  2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in addition to requirements of Section 26 05 19:
1. Use insulated copper conductors unless otherwise indicated.
    - a. Exceptions:
      1. Use bare copper conductors where installed underground in direct contact with earth.
      2. Use bare copper conductors where directly encased in concrete (not in raceway).
  2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gauge of specified conductors.
- C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
  2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
    - a. Exceptions:
      1. Use mechanical connectors for connections to electrodes at ground access wells.
  3. Unless otherwise indicated, use mechanical connectors or exothermic welded connections for accessible connections.
    - a. Exceptions:
      1. Use exothermic welded connections for connections to metal building frame.
  4. Manufacturers - Mechanical and Compression Connectors:
    - a. Burndy: [www.burndy.com](http://www.burndy.com).
    - b. Harger Lightning & Grounding: [www.harger.com](http://www.harger.com).
    - c. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  5. Manufacturers - Exothermic Welded Connections:
    - a. Burndy: [www.burndy.com](http://www.burndy.com).

**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

- b. Cadweld, a brand of Erico International Corporation: [www.erico.com/#sle](http://www.erico.com/#sle).
  - c. ThermOweld, a brand of Continental Industries, Inc:  
[www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
  - d. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Ground Bars:
  - 1. Description: Copper rectangular ground bars with mounting brackets and insulators.
  - 2. Size: As specified herein.
  - 3. Holes for Connections: As indicated or as required for connections to be made.
  - 4. Manufacturers:
    - a. Erico International Corporation: [www.erico.com](http://www.erico.com).
    - b. Harger Lightning & Grounding: [www.harger.com](http://www.harger.com).
    - c. ThermOweld, a brand of Continental Industries, Inc:  
[www.thermoweld.com/#sle](http://www.thermoweld.com/#sle).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Ground Rod Electrodes:
  - 1. Comply with NEMA GR 1.
  - 2. Material: Copper-bonded (copper-clad) steel.
  - 3. Size: 5/8 inch diameter by 10 feet length, unless otherwise indicated.
  - 4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.
  - 5. Manufacturers:
    - a. Erico International Corporation: [www.erico.com](http://www.erico.com).
    - b. Galvan Industries, Inc: [www.galvanelectrical.com](http://www.galvanelectrical.com).
    - c. Harger Lightning & Grounding: [www.harger.com](http://www.harger.com).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.

**PART 3 EXECUTION****3.1. PREPARATION**

- A. Remove paint, rust, mill oils, and surface contaminants at connection points.

**3.2. EXAMINATION**

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as shown on the drawings.
- C. Verify that conditions are satisfactory for installation prior to starting work.

**3.3. INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NECA 1.

**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70.
  - 1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
  - 2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.
- D. Make grounding and bonding connections using specified connectors.
  - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
  - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
  - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
  - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
- E. Identify grounding and bonding system components in accordance with Section 26 05 53.

**3.4. FIELD QUALITY CONTROL**

- A. Perform inspection, testing, and adjusting in accordance with Section 01 40 00.
- B. Inspect and test in accordance with NETA ATS except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.13.
- D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.
- F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

**END OF SECTION**

**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Conduit and equipment supports.
- B. Anchors and fasteners.
- C. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

**1.2. RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 05 50 00 - Metal Fabrications: Materials and requirements for fabricated metal supports.
- C. Section 26 05 34 - Conduit: Additional support and attachment requirements for conduits.
- D. Section 26 05 37 - Boxes: Additional support and attachment requirements for boxes.
- E. Section 26 51 00 - Interior & Exterior Lighting: Additional support and attachment requirements for interior luminaires.

**1.3. REFERENCE STANDARDS**

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2015.
- D. MFMA-4 - Metal Framing Standards Publication; 2004.
- E. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2009.
- F. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2006
- G. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2010
- H. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2009.
- I. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

**1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.

**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

2. Coordinate the work with other trades to provide additional framing and materials required for installation.
  3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
  4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
  5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

**1.5. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
- D. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.
- E. Product Data: Provide manufacturer's catalog data for fastening systems.
- F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

**1.6. QUALITY ASSURANCE**

- A. Comply with NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- C. Comply with applicable building code.
- D. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

**PART 2 PRODUCTS****2.1. SUPPORT AND ATTACHMENT COMPONENTS**

- A. General Requirements:
  1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
  2. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or Intertek (ETL) as suitable for the purpose indicated, where applicable.



**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 5. Include consideration for vibration, equipment operation, and shock loads where applicable.
  4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
  5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
  6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    - a. Indoor Dry Locations: Use zinc-plated steel unless otherwise indicated.
    - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel or stainless steel unless otherwise indicated.
    - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Materials for Metal Fabricated Supports: Comply with Section 05 50 00.
- C. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
  2. Conduit Clamps: Bolted type unless otherwise indicated.
  3. Manufacturers:
    - a. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
    - b. Erico International Corporation: [www.erico.com](http://www.erico.com).
    - c. O-Z/Gedney, a brand of Emerson Industrial Automation: [www.emersonindustrial.com/#sle](http://www.emersonindustrial.com/#sle).
    - d. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
1. Manufacturers:
    - a. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
    - b. Erico International Corporation: [www.erico.com/#sle](http://www.erico.com/#sle).
    - c. O-Z/Gedney, a brand of Emerson Industrial Automation: [www.emersonindustrial.com/#sle](http://www.emersonindustrial.com/#sle).
    - d. Thomas & Betts Corporation: [www.tnb.com/#sle](http://www.tnb.com/#sle).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.
  2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.



**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

3. Channel Material:
  - a. Indoor Dry Locations: Use zinc-plated steel or galvanized steel.
  - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel or stainless steel.
4. Minimum Channel Thickness: 14 gauge.
5. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
6. Manufacturers:
  - a. Cooper B-Line, a division of Eaton Corporation: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
  - b. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
  - c. Unistrut, a brand of Atkore International Inc: [www.unistrut.com](http://www.unistrut.com).
  - d. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
  1. Minimum Size, Unless Otherwise Indicated or Required:
    - a. Equipment Supports: 1/2 inch diameter.
    - b. Single Conduit up to 1 inch (27mm) trade size: 1/4 inch diameter.
    - c. Single Conduit larger than 1 inch (27mm) trade size: 3/8 inch diameter.
    - d. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
    - e. Outlet Boxes: 1/4 inch diameter.
    - f. Luminaires: 3/8 inch diameter.
- G. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
  1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
  2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
  3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
  4. Manufacturers:
    - a. Cooper B-Line, a division of Eaton Corporation: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
    - b. Erico International Corporation: [www.erico.com](http://www.erico.com).
    - c. PHP Systems/Design: [www.phpsd.com](http://www.phpsd.com).
    - d. Unistrut, a brand of Atkore International Inc: [www.unistrut.com](http://www.unistrut.com).
    - e. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Anchors and Fasteners:
  1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
  2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
  3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
  4. Hollow Masonry: Use toggle bolts.
  5. Hollow Stud Walls: Use toggle bolts.

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6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners are permitted only as follows:
  - a. Where approved by Architect.
  - b. Use only threaded studs; do not use pins.
11. Hammer-driven anchors and fasteners are permitted only as follows:
  - a. Nails are permitted for attachment of nonmetallic boxes to wood frame construction (when specified).
  - b. Staples are permitted for attachment of nonmetallic-sheathed cable to wood frame construction (when specified).
12. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
  - a. Comply with MFMA-4.
  - b. Channel Material: Use galvanized steel.
  - c. Minimum Channel Thickness: 12 gauge.
  - d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
13. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
14. Manufacturers - Mechanical Anchors:
  - a. Hilti, Inc: [www.us.hilti.com](http://www.us.hilti.com).
  - b. ITW Red Head, a division of Illinois Tool Works, Inc: [www.itwredhead.com/#sle](http://www.itwredhead.com/#sle).
  - c. Powers Fasteners, Inc: [www.powers.com](http://www.powers.com).
  - d. Simpson Strong-Tie Company Inc: [www.strongtie.com](http://www.strongtie.com).
  - e. Substitutions: See Section 01 60 00 - Product Requirements.
15. Manufacturers - Powder-Actuated Fastening Systems:
  - a. Hilti, Inc: [www.us.hilti.com](http://www.us.hilti.com).
  - b. ITW Ramset, a division of Illinois Tool Works, Inc: [www.ramset.com/#sle](http://www.ramset.com/#sle).
  - c. Powers Fasteners, Inc: [www.powers.com](http://www.powers.com).
  - d. Simpson Strong-Tie Company Inc: [www.strongtie.com](http://www.strongtie.com).
  - e. Substitutions: See Section 01 60 00 - Product Requirements.

**2.2. MATERIALS**

- A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
- B. Supports: Fabricated of structural steel or formed steel members; galvanized.
- C. Anchors and Fasteners:
  1. Obtain permission from Architect before using powder-actuated anchors.

**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

2. Concrete Structural Elements: Use precast inserts, expansion anchors, or preset inserts.
  3. Steel Structural Elements: Use beam clamps, steel spring clips, steel ramset fasteners, or welded fasteners.
  4. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
  5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts or hollow wall fasteners.
  6. Solid Masonry Walls: Use expansion anchors or preset inserts.
  7. Sheet Metal: Use sheet metal screws.
  8. Wood Elements: Use wood screws.
- D. Fastener Types:
1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
  2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
  3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
  4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
  5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
  6. Other Types: As required.
  7. Manufacturers:
    - a. Powers Fasteners, Inc: [www.powers.com](http://www.powers.com).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Formed Steel Channel:
1. Manufacturer: Kindorf, Unistrut, B-Line, or approved.
  2. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Steel Spring Clips:
1. Manufacturer: Caddy, Raco, T&B, B-Line.
  2. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
  2. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
  3. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
  4. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
  5. Manufacturers:
    - a. Cooper B-Line, a division of Cooper Industries: [www.cooperindustries.com](http://www.cooperindustries.com).
    - b. PHP Systems/Design: [www.phpsd.com](http://www.phpsd.com).
    - c. Unistrut, a brand of Atkore International Inc: [www.unistrut.com](http://www.unistrut.com).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.

**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS****PART 3 EXECUTION****3.1. EXAMINATION**

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

**3.2. INSTALLATION**

- A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
  - 1. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
  - 2. Obtain permission from Architect before drilling or cutting structural members.
- B. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- C. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- D. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.
- E. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- F. Install products in accordance with manufacturer's instructions.
- G. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.
- H. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- I. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- J. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- K. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- L. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- M. Field-Welding (where approved by Architect): Comply with Section 05 50 00.
- N. Equipment Support and Attachment:
  - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
  - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
  - 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.

**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

- 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- O. Conduit Support and Attachment: Also comply with Section 26 05 34.
- P. Box Support and Attachment: Also comply with Section 26 05 37.
- Q. Interior Luminaire Support and Attachment: Also comply with Section 26 51 00.
- R. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- S. Secure fasteners according to manufacturer's recommended torque settings.
- T. Remove temporary supports.
- U. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) in accordance with NFPA 70.

**3.3. FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.

**END OF SECTION**

**CONDUIT****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Galvanized steel rigid metal conduit (RMC).
- B. Intermediate metal conduit (IMC).
- C. Flexible metal conduit (FMC).
- D. Liquidtight flexible metal conduit (LFMC).
- E. Electrical metallic tubing (EMT).
- F. Rigid polyvinyl chloride (PVC) conduit.
- G. Liquidtight flexible nonmetallic conduit (LFNC).
- H. Conduit fittings.
- I. Accessories.

**1.2. RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete encasement of conduits.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Metal clad cable (Type MC), armored cable (Type AC), and manufactured wiring systems, including uses permitted.
- C. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
  - 1. Includes additional requirements for fittings for grounding and bonding.
- D. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- E. Section 26 05 37 - Boxes.
- F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 2701 - Group Metering Equipment: Additional requirements for electrical service conduits.

**1.3. REFERENCE STANDARDS**

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
- B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.
- C. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); 2005.
- D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
- G. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.
- H. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- I. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; 2005.

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- J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.
- K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2015.
- L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- N. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- O. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.
- P. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
- Q. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- R. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- S. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- T. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.
- U. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.
- V. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

**1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
  - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
  - 4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
  - 5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.
- C. For projects with Post Tension (PT) slab construction, submit dimensioned plan showing all conduit sleeves & block out locations to Architect for review.

**1.5. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.
- B. Shop Drawings:



**CONDUIT**

1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
  2. Include proposed locations of roof penetrations and proposed methods for sealing.
- C. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

**1.6. QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

**1.7. DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

**PART 2 PRODUCTS****2.1. CONDUIT APPLICATIONS**

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications.
- C. Underground:
  1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
  2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), or rigid PVC conduit.
  3. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit or intermediate metal conduit (IMC) where emerging from underground.
  4. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows or intermediate metal conduit (IMC) elbows or fiberglass for bends in runs over 100 feet. For shorter runs factory formed schedule 40 PVC elbows may be used.
  5. 1.5 Inches Diameter and Smaller: For total conduit lengths between pull points over 100 ft., use rigid steel elbows. For shorter overall lengths, rigid steel or Schedule 40 PVC may be used.
  6. Where steel conduit is installed in direct contact with earth use where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience to provide supplementary corrosion protection.



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- D. Embedded Within Concrete:
1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or rigid PVC conduit.
  2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), electrical metallic tubing (EMT), or rigid PVC conduit.
  3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), electrical metallic tubing (EMT), or rigid PVC conduit.
  4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit or intermediate metal conduit (IMC) where emerging from concrete.
  5. Where electrical metallic tubing (EMT) emerges from concrete into salt air, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges.
- E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- I. Exposed, Interior: Install intermediate metal conduit (IMC) where installed below the bottom chord of trusses, use EMT conduit where installed above cord of trusses.
- J. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.
- K. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- L. Corrosive Locations Above Ground: Use rigid PVC conduit.
1. Corrosive locations include, but are not limited to:
    - a. Cooling towers.
    - b. Swimming pool equipment rooms.
- M. Hazardous (Classified) Locations: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- N. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
1. Maximum Length: 6 feet.
- O. Connections to Vibrating Equipment:
1. Dry Locations: Use flexible metal conduit.
  2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
  3. Maximum Length: 6 feet unless otherwise indicated.
  4. Vibrating equipment includes, but is not limited to:
    - a. Transformers.

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## b. Motors.

- P. Insulate conduits entering coolers at the first 48".

**2.2. CONDUIT REQUIREMENTS**

- A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.
- B. Electrical Service Conduits/
- C. Communications Systems Conduits.
- D. Fittings for Grounding and Bonding: Also comply with Section 26 05 26.
- E. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- F. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or Intertek (ETL) as suitable for the purpose indicated.
- G. Minimum Conduit Size, Unless Otherwise Indicated:
  - 1. Branch Circuits: 1/2 inch (16 mm) trade size.
  - 2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
  - 3. Control Circuits: 1/2 inch (16 mm) trade size.
  - 4. Flexible Connections to Luminaires: 1/2 inch (16 mm) trade size.
  - 5. Underground, Interior: 3/4 inch (21 mm) trade size.
  - 6. Underground, Exterior: 3/4 inch (21 mm) trade size.
- H. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

**2.3. GALVANIZED STEEL RIGID METAL CONDUIT (RMC)**

- A. Manufacturers:
  - 1. Allied Tube & Conduit: [www.alliedeg.com](http://www.alliedeg.com).
  - 2. Republic Conduit: [www.republic-conduit.com](http://www.republic-conduit.com).
  - 3. Wheatland Tube Company: [www.wheatland.com](http://www.wheatland.com).
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
  - 1. Manufacturers:
    - a. Bridgeport Fittings Inc: [www.bptfittings.com](http://www.bptfittings.com).
    - b. O-Z/Gedney, a brand of Emerson Industrial Automation: [www.emersonindustrial.com/#sle](http://www.emersonindustrial.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
  - 2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
  - 4. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.

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5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

**2.4. INTERMEDIATE METAL CONDUIT (IMC)**

- A. Manufacturers:
  1. Allied Tube & Conduit: [www.alliedeg.com](http://www.alliedeg.com).
  2. Republic Conduit: [www.republic-conduit.com](http://www.republic-conduit.com).
  3. Wheatland Tube Company: [www.wheatland.com](http://www.wheatland.com).
- B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- C. Fittings:
  1. Manufacturers:
    - a. Bridgeport Fittings Inc: [www.bptfittings.com](http://www.bptfittings.com).
    - b. O-Z/Gedney, a brand of Emerson Industrial Automation: [www.emersonindustrial.com/#sle](http://www.emersonindustrial.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
  2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
  4. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.
  5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

**2.5. FLEXIBLE METAL CONDUIT (FMC)**

- A. Manufacturers:
  1. AFC Cable Systems, Inc: [www.afcweb.com](http://www.afcweb.com).
  2. Electri-Flex Company: [www.electriflex.com](http://www.electriflex.com).
  3. International Metal Hose: [www.metalhose.com](http://www.metalhose.com).
- B. Description: NFPA 70, Type FMC standard wall steel or standard wall aluminum flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- C. Fittings:
  1. Manufacturers:
    - a. Bridgeport Fittings Inc: [www.bptfittings.com](http://www.bptfittings.com).
    - b. O-Z/Gedney, a brand of Emerson Industrial Automation: [www.emersonindustrial.com/#sle](http://www.emersonindustrial.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
  2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  3. Material: Use steel, malleable iron, or aluminum.
    - a. Do not use die cast zinc fittings.

**CONDUIT****2.6. LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)**

- A. Manufacturers:
  - 1. AFC Cable Systems, Inc: [www.afcweb.com](http://www.afcweb.com).
  - 2. Electri-Flex Company: [www.electriflex.com](http://www.electriflex.com).
  - 3. International Metal Hose: [www.metalhose.com](http://www.metalhose.com).
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel or aluminum flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
  - 1. Manufacturers:
    - a. Bridgeport Fittings Inc: [www.bptfittings.com](http://www.bptfittings.com).
    - b. O-Z/Gedney, a brand of Emerson Industrial Automation: [www.emersonindustrial.com/#sle](http://www.emersonindustrial.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
  - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 3. Material: Use steel, malleable iron, or aluminum.
    - a. Do not use die cast zinc fittings.

**2.7. ELECTRICAL METALLIC TUBING (EMT)**

- A. Manufacturers:
  - 1. Allied Tube & Conduit: [www.alliedeg.com](http://www.alliedeg.com).
  - 2. Republic Conduit: [www.republic-conduit.com](http://www.republic-conduit.com).
  - 3. Wheatland Tube Company: [www.wheatland.com](http://www.wheatland.com).
- B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
  - 1. Manufacturers:
    - a. Bridgeport Fittings Inc: [www.bptfittings.com](http://www.bptfittings.com).
    - b. O-Z/Gedney, a brand of Emerson Industrial Automation: [www.emersonindustrial.com/#sle](http://www.emersonindustrial.com/#sle).
    - c. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
  - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 3. Material: Use steel.
    - a. Do not use die cast zinc fittings.
  - 4. Connectors and Couplings: Use set-screw type except when embedded in concrete. Use concrete tight compression (gland) type in concrete.
    - a. Do not use indenter type connectors and couplings.
  - 5. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
  - 6. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are not acceptable.

**CONDUIT****2.8. RIGID POLYVINYL CHLORIDE (PVC) CONDUIT**

- A. Manufacturers:
  - 1. Cantex Inc: [www.cantexinc.com](http://www.cantexinc.com).
  - 2. Carlon, a brand of Thomas & Betts Corporation: [www.carlon.com](http://www.carlon.com).
  - 3. JM Eagle: [www.jmeagle.com](http://www.jmeagle.com).
  - 4. Allied Tube and Conduit: [www.alliedtube.com](http://www.alliedtube.com).
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- C. Fittings:
  - 1. Manufacturer: Same as manufacturer of conduit to be connected.
  - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.
- D. Elbows:
  - 1. Use only factory formed Schedule 40 elbows. Field bends are not acceptable.
  - 2. 1.5 Inches Diameter and Smaller: For total conduit lengths between pull points over 100 ft., use rigid steel elbows. For shorter overall lengths, rigid steel or Schedule 40 PVC may be used.
  - 3. 2 Inches Diameter and Larger: For total conduit lengths between pull points over 100 ft., use long sweep rigid steel or fiberglass elbows. For shorter overall lengths, rigid steel, fiberglass, or Schedule 40 PVC elbows may be used.

**2.9. LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)**

- A. Manufacturers:
  - 1. AFC Cable Systems, Inc: [www.afcweb.com](http://www.afcweb.com).
  - 2. Electri-Flex Company: [www.electriflex.com](http://www.electriflex.com).
  - 3. International Metal Hose: [www.metalhose.com](http://www.metalhose.com).
- B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660, Type A.
- C. Fittings:
  - 1. Manufacturer: Same as manufacturer of conduit to be connected.
  - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.

**2.10. ACCESSORIES**

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 10 mil.
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

**CONDUIT**

- D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.
- E. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.
- F. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

**PART 3 EXECUTION****3.1. EXAMINATION**

- A. Verify that field measurements are as shown on drawings.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

**3.2. INSTALLATION**

- A. Conduits to dock levelers may be routed in PVC below slab.
- B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- E. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- F. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.
- G. Conduit Routing:
  - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
  - 2. When conduit destination is indicated and routing is not shown, determine exact routing required.
  - 3. Conceal all conduits unless specifically indicated to be exposed.
  - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
    - a. Electrical rooms.
    - b. Mechanical equipment rooms.
    - c. Within joists in areas with no ceiling.
  - 5. Unless otherwise approved, do not route conduits exposed:
    - a. Across floors.
    - b. Across roofs.
    - c. Across top of parapet walls.
    - d. Across building exterior surfaces.
  - 6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
  - 7. Arrange conduit to maintain adequate headroom, clearances, and access.
  - 8. Arrange conduit to provide no more than the equivalent of three 90 degree bends between pull points.
  - 9. Arrange conduit to provide no more than 150 feet between pull points.

**CONDUIT**

10. Route conduits above water and drain piping where possible.
  11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
  12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
  13. Maintain minimum clearance of 12 inches between conduits and hot surfaces.
  14. Group parallel conduits in the same area together on a common rack.
- H. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
  2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
  3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
  4. Use conduit strap to support single surface-mounted conduit.
    - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
  5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
  6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
  7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
  8. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where specifically approved).
  9. Use of spring steel conduit clips for support of conduits is permitted only as follows:
    - a. Support of electrical metallic tubing (EMT) up to 1 inch (27 mm) trade size concealed above accessible ceilings and within hollow stud walls.
  10. Use of wire for support of conduits is not permitted.
  11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.
- I. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
  2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
  3. Use suitable adapters where required to transition from one type of conduit to another.
  4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
  5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.



**CONDUIT**

6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
  7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
  8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- J. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
  2. Make penetrations perpendicular to surfaces unless otherwise indicated.
  3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
  4. Conceal bends for conduit risers emerging above ground.
  5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
  6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
  7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
  8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
  9. Provide metal escutcheon plates for conduit penetrations exposed to public view.
  10. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- K. Underground Installation:
1. Provide trenching and backfilling .
  2. Minimum Cover, Unless Otherwise Indicated or Required:
    - a. Underground, Exterior: 24 inches.
    - b. Under Slab on Grade: 12 inches to bottom of slab.
  3. Provide underground warning tape in accordance with Section 26 05 53 along entire conduit length for service entrance where not concrete-encased.
- L. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Include proposed conduit arrangement with submittals.
  2. Maximum Conduit Size: 1 inch (27 mm) unless otherwise approved.
  3. Minimum Conduit Spacing: Shall be as directed by Structural Engineer.
  4. Install conduits within middle one third of slab thickness.
  5. Secure conduits to prevent floating or movement during pouring of concrete.
- M. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03 30 00 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.



**CONDUIT**

- N. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.
- O. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings or approved flexible connections to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
  - 1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
  - 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
  - 3. Where conduits are subject to earth movement by settlement or frost.
- P. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
  - 1. Where conduits pass from outdoors into conditioned interior spaces.
  - 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
  - 3. Where conduits penetrate coolers or freezers.
- Q. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- R. Provide grounding and bonding in accordance with Section 26 05 26.
- S. Identify conduits in accordance with Section 26 05 53.
- T. Do not cross conduits in slab.
- U. Cut conduit square using saw or pipecutter; de-burr cut ends.
- V. Bring conduit to shoulder of fittings; fasten securely.
- W. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes minimum.
- X. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- Y. All elbows installed in primary and secondary power conduit runs shall be minimum 36-inch radius.
- Z. Where conduit is shown stubbed into a telephone, computer or communication terminal area, conduit shall be stubbed up 6 inches below ceiling and terminated with insulating bushings.
- AA. Where the contractor elects to utilize PVC in lieu of GRC, the contractor shall provide supplemental ground bus in terminating switch and panelboards, and green ground wire as per code rules.
- AB. Conduit runs shall not exceed 100 feet without an accessible pull box installed in line.
- AC. Communications system conduit run above the ceiling shall not be installed within 12 inches of a parallel run of current carrying conductors, transformers, feeder cables, motors, or lighting ballasts.

**CONDUIT**

- AD. Conduit connections between outlet boxes less than 24 inches apart on opposite sides of a wall shall be made with a loop of flexible conduit to limit sound transmission.
- AE. Penetrations of Masonry and Concrete Constructions:
1. Ensure that the sound control performance of structures be maintained in accordance with the drawings and specifications. All penetrations shall be installed in a manner that results in complete air tightness through structure. If a condition occurs where penetration of the structure by a conduit is not shown clearly on the drawings (or described in the specifications), the Contractor shall ask immediately for clarification of the method necessary to install the particular item.
- AF. Penetrations of Drywall Constructions:
1. Ensure that the sound control performance of structures be maintained in accordance with the drawings and specifications. All penetrations shall be installed in a manner that results in complete air tightness through structure. If a condition occurs where penetration of the structure by a conduit is not shown clearly on the drawings (or described in the specifications), the Contractor shall ask immediately for clarification of the method necessary to install the particular item.
- AG. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

**3.3. FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective conduits.

**3.4. CLEANING**

- A. Clean interior of conduits to remove moisture and foreign matter.

**3.5. PROTECTION**

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

**END OF SECTION**

**BOXES****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.
- C. Boxes for hazardous (classified) locations.
- D. Floor boxes.
- E. Underground boxes/enclosures.

**1.2. RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 34 - Conduit:
  - 1. Conduit bodies and other fittings.
  - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- E. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 27 01 - Wall Mounted Group Metering Equipment: Metering transformer cabinets.
- G. Section 26 27 26 - Wiring Devices:
  - 1. Wall plates.

**1.3. REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.
- E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013.
- F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. SCTE 77 - Specification for Underground Enclosure Integrity; 2017.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- K. UL 508A - Industrial Control Panels; 2013.
- L. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

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- M. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

**1.4. ADMINISTRATIVE REQUIREMENTS****A. Coordination:**

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

**1.5. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency.
- C. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Keys for Lockable Enclosures: Two of each different key.

**1.6. QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Products: Provide products listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.
- C. Electrical boxes shall be sized according to NEC requirements unless otherwise noted in the contract documents.
- D. Maintain integrity of insulation materials where flush boxes are installed in insulated spaces.
- E. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

**BOXES****1.7. DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

**PART 2 PRODUCTS****2.1. BOXES**

- A. General Requirements:
1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
  2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
  3. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or Intertek (ETL) as suitable for the purpose indicated.
  4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
  5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including those used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
  2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
  3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
  4. Use cast aluminum boxes where aluminum rigid metal conduit is used.
  5. Use nonmetallic boxes where exposed rigid PVC conduit is used.
  6. Use suitable concrete type boxes where flush-mounted in concrete.
  7. Use suitable masonry type boxes where flush-mounted in masonry walls.
  8. Use raised covers suitable for the type of wall construction and device configuration where required.
  9. Use shallow boxes where required by the type of wall construction.
  10. Do not use "through-wall" boxes designed for access from both sides of wall.
  11. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
  12. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
  13. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C, permitted in residential units only.

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14. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
15. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.
16. Minimum Box Size, Unless Otherwise Indicated:
  - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
  - b. Communications Systems Outlets: Comply with Section 27 10 00.
  - c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
17. Wall Plates: Comply with Section 26 27 26.
18. Manufacturers:
  - a. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
  - b. Hubbell Incorporated; Bell Products: [www.hubbell-bell.com](http://www.hubbell-bell.com).
  - c. Hubbell Incorporated; RACO Products: [www.hubbell-raco.com](http://www.hubbell-raco.com).
  - d. O-Z/Gedney, a brand of Emerson Industrial Automation: [www.emersonindustrial.com/#sle](http://www.emersonindustrial.com/#sle).
  - e. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
  - f. Appleton Electric.
  - g. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
  1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
  2. NEMA 250 Environment Type, Unless Otherwise Indicated:
    - a. Indoor Clean, Dry Locations: Type 1, painted steel.
    - b. Outdoor Locations: Type 3R, painted steel.
  3. Junction and Pull Boxes Larger Than 100 cubic inches:
    - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
    - b. Boxes 6 square feet and Larger: Provide hinged-cover enclosures.
  4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    - a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
    - b. Back Panels: Painted steel, removable (where applicable).
  5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
  6. Manufacturers:
    - a. Cooper B-Line, a division of Eaton Corporation: [www.cooperindustries.com/#sle](http://www.cooperindustries.com/#sle).
    - b. Hoffman, a brand of Pentair Technical Products: [www.hoffmanonline.com/#sle](http://www.hoffmanonline.com/#sle).

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- c. Hubbell Incorporated; Wiegmann Products:  
www.hubbell-wiegmann.com/#sle.
  - d. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Electrical Outlet Box Pad:
  - 1. Electrical outlet box pads shall be applied where called out on the drawings or specifications. Its function is to seal box openings, increase mass, and provide damping to reduce air-transmitted sound through party walls. It shall consist of polybutene-butyl and inert fillers. Material shall provide good adhesion to metal and plastic. Pads shall be applied to the backs of installed electrical boxes, molded to box, and folded around conduit cable entering the box. Pads shall not be used in areas subject to temperatures above 200 degrees F.
  - 2. The following are acceptable, subject to the above:
    - a. Lowry's outlet box pads from Harry A. Lowry & Associates, Inc., Sun Valley, California, (800) 225-8231.
    - b. SpecSeal firestop putty pads (fire-rated) from Specified Technologies, Incorporated, Somerville, New Jersey, (800) 992-1180.
    - c. Or approved equal.
- E. In-Ground Cast Metal Box: NEMA 250, Type 6, flanged, recessed cover box for flush mounting:

**PART 3 EXECUTION****3.1. EXAMINATION**

- A. Verify exact location of floor boxes with Architect.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

**3.2. INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. Box Locations:
  - 1. Locate boxes to be accessible. Provide access panels as required where approved by the Architect.



**BOXES**

- a. Coordinate exact location of infloor boxes with Architect.
    - b. Adjust box locations up to 10 feet if required to accommodate intended purpose, at no additional cost to the owner.
  2. Unless dimensioned, box locations indicated are approximate.
  3. Locate boxes as required for devices installed under other sections or by others.
    - a. Switches, Receptacles, and Other Wiring Devices: Comply as indicated on drawings.
    - b. Communications Systems Outlets: Comply as indicated on drawings.
  4. Locate boxes so that wall plates do not span different building finishes.
  5. Locate boxes so that wall plates do not cross masonry joints.
  6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
  7. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
  8. Fire-Resistance-Rated Walls: Install flush-mounted boxes such that the required fire-resistance will not be reduced.
    - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities protect both boxes with listed putty pads.
    - b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
  9. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 34.
  10. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    - a. Concealed above accessible suspended ceilings.
    - b. Within joists in areas with no ceiling.
    - c. Electrical rooms.
    - d. Mechanical equipment rooms.
- I. Box Supports:
  1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
  2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
  3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
  4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.



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- J. Install boxes plumb and level.
- K. Flush-Mounted Boxes:
  - 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
  - 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
  - 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- L. Floor-Mounted Cabinets: Mount on properly sized 3 inch high concrete pad constructed in accordance with Section 03 30 00.
- M. Install boxes as required to preserve insulation integrity.
- N. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.
- O. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.
- P. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.
- R. Close unused box openings.
- S. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- T. Provide grounding and bonding in accordance with Section 26 05 26.
- U. Identify boxes in accordance with Section 26 05 53.
  - 1. Adjust box locations up to 10 feet if required to accommodate intended purpose, at no additional cost to Owner.
- V. Orient boxes to accommodate wiring device orientation as specified in Section 26 27 26.
- W. Maintain headroom and present neat mechanical appearance.
- X. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- Y. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- Z. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- AA. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- AB. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
  - 1. Acoustic rated walls.
    - a. In a single stud wall, there shall be a separation of 24 inches between centerlines of outlet boxes or receptacles set into opposite sides of the wall. When these boxes are of dimensions exceeding 4 inches wide, this dimension (24 inches) shall be clear between the side walls, providing a full 24-inch separation regardless of the box size. Conduit connecting such boxes shall be flexible and shall provide 6 inches slack per 24 inches of run.

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- b. In a double stud wall, boxes in opposite sides of the wall shall be located 24 inches on center, minimum. Effectively, this means that boxes on the same side of the wall will be 48 inches apart if there is a box between them on the other side of the wall. Conduit, in the case of a double wall, shall home run to a point outside of the partition before connecting to cable and conduit connecting boxes on the other side. Conduit, which shall be flexible, may thread through the studs on its own side but shall under no circumstances interface with the stud on the other side of the wall.
  - c. The boxes shall be treated to reduce sound transmission. All unused knock-out holes shall be plugged with knock-out caps. The openings or cutouts in the walls to receive the boxes/receptacles shall be made no more than 1-1/4 inches oversize to allow a gap all around of 1-1/8 inches. The flanges shall be perimeter sealed with acoustical caulking, prior to the boxes/receptacles being inserted.
  - d. An outlet box pad, which acts to increase mass and provides damping, shall be applied to the backs of back-to-back electrical boxes separated by less than 24 inches, or where the box is installed in acoustical barrier walls. Refer to architectural wall types.
- AC. Use stamped steel bridges to fasten flush mounting outlet box between studs.
  - AD. Use adjustable steel channel fasteners for hung ceiling outlet box.
  - AE. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.
  - AF. Locate outlet boxes so that the wall plates do not cross masonry joints or span different building finishes.

**3.3. CLEANING**

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.
- B. Clean exposed surfaces and restore finish.

**3.4. PROTECTION**

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

**3.5. INTERFACE WITH OTHER PRODUCTS**

- A. Coordinate installation of outlet box with products furnished under other sections of these specifications.
- B. Coordinate locations and sizes of required access doors.
- C. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- D. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes with architectural drawings.

**END OF SECTION**

**IDENTIFICATION FOR ELECTRICAL SYSTEMS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Underground warning tape.

**1.2. RELATED REQUIREMENTS**

- A. Section 09 90 00 - Painting and Coating.
- B. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

**1.3. REFERENCE STANDARDS**

- A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. NFPA 70E - Standard for Electrical Safety in the Workplace; 2017.

**1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
  - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
  - 2. Do not install identification products until final surface finishes and painting are complete.

**1.5. QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.

**1.6. FIELD CONDITIONS**

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

**PART 2 PRODUCTS****2.1. IDENTIFICATION REQUIREMENTS**

- A. Existing Work: Unless specifically excluded, identify existing elements to remain whose designations are changed as part of the new work.
- B. Identification for Equipment:

**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
  - a. Switchboards:
    1. Identify ampere rating.
    2. Identify voltage and phase.
    3. Identify power source.
    4. Use identification nameplate to identify main overcurrent protective device.
    5. Use identification nameplate to identify load(s) served for each branch device. Identify spares.
  - b. Panelboards:
    1. Identify ampere rating.
    2. Identify voltage and phase.
    3. Identify power source.
    4. Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
    5. Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces. Identify load type, circuit number, breaker size and number of poles, and circuit load in volt-amps.
    6. For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares.
  - c. Transformers:
    1. Identify kVA rating.
    2. Identify voltage and phase for primary and secondary.
    3. Identify power source.
    4. Identify load(s) served.
  - d. Enclosed switches, circuit breakers, and motor controllers:
    1. Identify voltage and phase.
    2. Identify power source.
    3. Identify load(s) served.
  - e. Busway:
    1. Identify ampere rating.
    2. Identify voltage and phase.
    3. Identify power source.
    4. Provide identification at maximum intervals of 40 feet, minimum of one label per floor.
    5. Use identification nameplate to identify load(s) served for each plug-in unit.
  - f. Time Switches:
    1. Identify load(s) served and associated circuits controlled. Include location.
  - g. Enclosed Contactors:
    1. Identify voltage and phase.

**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

2. Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).
  3. Identify coil voltage.
  4. Identify load(s) and associated circuits controlled. Include location.
2. Service Equipment:
  - a. Use identification nameplate to identify each service disconnecting means.
  - b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
  - c. Use identification nameplate or identification label at each piece of service equipment to identify the available fault current and the date calculations were performed.
3. Emergency System Equipment:
  - a. Use identification nameplate to identify emergency system equipment in accordance with NFPA 70.
  - b. Use identification nameplate or identification label at each piece of service equipment to identify type and location of on-site emergency power sources.
  - c. Use identification nameplate or identification label to identify emergency operating instructions for emergency system equipment.
4. Use voltage marker or identification label to identify highest voltage present for each piece of electrical equipment with voltage 480 V or higher.
5. Use identification nameplate or identification label to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
6. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
7. Use identification label, identification nameplate, or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
8. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
  - a. Minimum Size: 5 by 7 inches.
  - b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.

**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

- c. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as indicated on the drawings:
  - 1. Include orange header that reads "WARNING" where calculated incident energy is less than 40 calories per square cm.
  - 2. Include red header that reads "DANGER" where calculated incident energy is 40 calories per square cm or greater.
  - 3. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
  - 4. Include the following information:
    - a. Arc flash protection boundary.
    - b. Incident energy.
    - c. Hazard/risk category.
    - d. PPE (personnel protective equipment) requirements.
    - e. Nominal voltage.
    - f. Shock hazard condition.
    - g. Limited approach boundary.
    - h. Restricted approach boundary.
    - i. Prohibited approach boundary.
    - j. Equipment identification.
    - k. Date calculations were performed.
- C. Identification for Conductors and Cables:
  - 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.  
  
480/277V, 3 Phase, 4 Wire System  
Phase A - Brown  
Phase B - Orange  
Phase C - Yellow  
Neutral - Gray  
Ground - Green  
  
Less than 250 Volts Between Phases:  
Phase A - Black  
Phase B - Red  
Phase C - Blue  
Neutral - White  
Ground - Green
  - 2. Identification for Communications Conductors and Cables: Comply with Section 27 10 00.
  - 3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:

**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

- a. At each source and load connection.
  - b. Within boxes when more than one circuit is present.
  - c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
- 4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
- 5. Use underground warning tape to identify direct buried cables.
- D. Identification for Raceways:
  - 1. Use underground warning tape to identify underground raceways.
- E. Identification for Boxes:
  - 1. Fire Alarm System: Red.
  - 2. For exposed boxes in public areas, do not color code.
  - 3. Use handwritten text using indelible marker to identify circuits enclosed.
    - a. For exposed boxes in public areas, provide identification on inside face of cover.
- F. Identification for Devices:
  - 1. Identification for Communications Devices: Comply with Section 27 10 00.
  - 2. Use identification label to identify serving branch circuit for all receptacles.
  - 3. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

**2.2. IDENTIFICATION NAMEPLATES AND LABELS**

- A. Identification Nameplates:
  - 1. Manufacturers:
    - a. Brimar Industries, Inc: [www.brimar.com](http://www.brimar.com).
    - b. Kolbi Pipe Marker Co: [www.kolbipipemarkers.com](http://www.kolbipipemarkers.com).
    - c. Seton Identification Products: [www.seton.com](http://www.seton.com).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
  - 2. Materials:
    - a. Indoor Clean, Dry Locations: Use plastic nameplates.
    - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
  - 3. Plastic Nameplates: Two-layer or three-layer laminated electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
    - a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
  - 4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
  - 5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
  - 6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:

**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

1. Manufacturers:
  - a. Brady Corporation: [www.bradyid.com](http://www.bradyid.com).
  - b. Brother International Corporation: [www.brother-usa.com](http://www.brother-usa.com).
  - c. Panduit Corp: [www.panduit.com](http://www.panduit.com).
  - d. Substitutions: See Section 01 60 00 - Product Requirements.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
  - a. Use only for indoor locations.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

**2.3. WIRE AND CABLE MARKERS**

- A. Manufacturers:
  1. Brady Corporation: [www.bradyid.com](http://www.bradyid.com).
  2. HellermannTyton: [www.hellermannntyton.com](http://www.hellermannntyton.com).
  3. Panduit Corp: [www.panduit.com](http://www.panduit.com).
  4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
  1. Do not use self-adhesive type markers.
- C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- D. Legend: Power source and circuit number or other designation indicated.
- E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
  1. Do not use handwritten text.
- F. Minimum Text Height: 1/8 inch.
- G. Color: Black text on white background unless otherwise indicated.

**2.4. UNDERGROUND WARNING TAPE**

- A. Manufacturers:
  1. Brady Corporation: [www.bradyid.com](http://www.bradyid.com).
  2. Brimar Industries, Inc: [www.brimar.com](http://www.brimar.com).
  3. Seton Identification Products: [www.seton.com](http://www.seton.com).
  4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Materials: Use non-detectable type OR foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
  1. Exception: Use foil-backed detectable type tape where required by serving utility or as noted.
    - a. Non-detectable Type Tape: 3 inches wide, with minimum thickness of 4 mil.
  2. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.



**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

- C. Legend: Type of service, continuously repeated over full length of tape.
- D. Color:
  - 1. Tape for Buried Power Lines: Black text on red background.
  - 2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

**PART 3 EXECUTION****3.1. PREPARATION**

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

**3.2. INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
  - 1. Surface-Mounted Equipment: Enclosure front.
  - 2. Flush-Mounted Equipment: Inside of equipment door or enclosure front.
  - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
  - 4. Elevated Equipment: Legible from the floor or working platform.
  - 5. Branch Devices: Adjacent to device.
  - 6. Interior Components: Legible from the point of access.
  - 7. Conduits: Legible from the floor.
  - 8. Boxes: Outside face of cover unless otherwise noted.
  - 9. Conductors and Cables: Legible from the point of access.
  - 10. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws, rivets, self-adhesive backing, or epoxy cement and to interior surfaces using self-adhesive backing or epoxy cement.
  - 1. Do not use adhesives on exterior surfaces except where substrate can not be penetrated.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 6 inches below finished grade. For trenches over 18 inches wide, install additional marker tape such that they are not over 10 inches apart (edge to edge) over the entire width of the trench.
- G. Secure rigid signs using stainless steel screws.
- H. Mark all handwritten text, where permitted, to be neat and legible.

**IDENTIFICATION FOR ELECTRICAL SYSTEMS****3.3. FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Shielded transformers.

**1.2. RELATED REQUIREMENTS**

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

**1.3. REFERENCE STANDARDS**

- A. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers; 2015.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers; 2015.
- D. NEMA ST 20 - Dry-Type Transformers for General Applications; 2014.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- F. NEMA TP 1 - Guide for Determining Energy Efficiency for Distribution Transformers; National Electrical Manufacturers Association; 2002.
- G. NEMA TP 2 - Standard Test Method for Measuring the Energy Consumption of Distribution Transformers; National Electrical Manufacturers Association; 2005.
- H. NEMA TP 3 - Standard for the Labeling of Distribution Transformer Efficiency; National Electrical Manufacturers Association; 2000.
- I. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 506 - Standard for Specialty Transformers; Current Edition, Including All Revisions.
- L. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers; Current Edition, Including All Revisions.

**1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate the work with placement of support framing and anchors required for mounting of transformers.

**1.5. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.
  - 1. Vibration Isolators: Include attachment method and rated load and deflection.

**LOW-VOLTAGE TRANSFORMERS**

2. Shielded Transformers: Include shielding method and noise attenuation performance.
3. Small Power Centers: Include panelboard bus ampacity, integrated short circuit ampere rating, and circuit breaker sizes and ampere ratings.
- C. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.
  1. Small Power Centers: Include panel arrangements.
- D. Source Quality Control Test Reports: Include reports for tests designated in NEMA ST 20 as design and routine tests.
- E. Field Quality Control Test Reports.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Maintenance Data: Include recommended maintenance procedures and intervals.
- H. Project Record Documents: Record actual locations of transformers.

**1.6. QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

**1.7. DELIVERY, STORAGE, AND HANDLING**

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

**1.8. FIELD CONDITIONS**

- A. Ambient Temperature: Do not exceed 86 degrees F average or 104 degrees F maximum measured during any 24 hour period during and after installation of transformers.

**1.9. WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

**PART 2 PRODUCTS****2.1. MANUFACTURERS**

- A. Eaton Corporation: [www.eaton.com](http://www.eaton.com).
- B. General Electric Company: [www.geindustrial.com/#sle](http://www.geindustrial.com/#sle).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us/#sle](http://www.schneider-electric.us/#sle).

**LOW-VOLTAGE TRANSFORMERS**

- D. Siemens.
- E. Source Limitations: Furnish transformers produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

**2.2. SHIELDED TRANSFORMERS**

- A. Description: Self-cooled, two winding, shielded isolation transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.
- B. Primary Voltage: As indicated on Drawings.
- C. Secondary Voltage: As indicated on Drawings.
- D. Insulation System and Allowable Average Winding Temperature Rise:
  - 1. Less than 15 kVA: Class 185 degrees C insulation system with 115 degrees C average winding temperature rise.
  - 2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.
- E. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.
- F. Winding Taps:
  - 1. Less than 3 kVA: None.
  - 2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
  - 3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
  - 4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.
- G. Energy Efficiency: Standard efficiency complying with NEMA TP 1.
  - 1. Test efficiency according to NEMA TP 2.
  - 2. Label transformer according to NEMA TP 3.
- H. Sound Levels: Standard sound levels complying with NEMA ST 20.
- I. Winding Shield: Electrostatic, with separate insulated grounding connection.
- J. Mounting Provisions:
  - 1. Less than 15 kVA: Suitable for wall mounting.
  - 2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
  - 3. Larger than 75 kVA: Suitable for floor mounting.
- K. Transformer Enclosure: Comply with NEMA ST 20.
  - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor clean, dry locations: Type 2.
    - b. Outdoor locations: Type 3R.
  - 2. Construction: Heavy gage steel.
    - a. Less than 15 kVA: Totally enclosed, non-ventilated.
    - b. 15 kVA and Larger: Ventilated.
  - 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
  - 4. Provide lifting eyes or brackets.
- L. Accessories:

**LOW-VOLTAGE TRANSFORMERS**

1. Mounting Brackets: Provide manufacturer's standard brackets.
  2. Weathershield Kits: Provide for ventilated transformers installed outdoors to provide a listed NEMA 250, type 3R assembly.
  3. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.
- M. All lugs shall be field replaceable compression type.

**2.3. SOURCE QUALITY CONTROL**

- A. Factory test transformers according to NEMA ST 20.
- B. Sound Level Tests: Perform factory test designated in NEMA ST 20 as "design" test on each production unit.

**PART 3 EXECUTION****3.1. EXAMINATION**

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.
- C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.
- D. Verify that conditions are satisfactory for installation prior to starting work.

**3.2. INSTALLATION**

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1.
- B. Install transformers in accordance with manufacturer's instructions.
- C. Install transformers in accordance with NECA 409 and IEEE C57.94.
- D. Use flexible conduit, under the provisions of Section 26 05 34, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.
- F. Set transformers plumb and level.
- G. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by the manufacturer.
- H. Mount floor-mounted transformers on properly sized 3 inch high concrete pad constructed.
- I. Mount floor-mounted transformers using vibration isolators suitable for isolating the transformer noise from the building structure.
- J. Mount trapeze-mounted transformers as indicated.
- K. Provide seismic restraints.
- L. Provide grounding and bonding in accordance with Section 26 05 26.

**LOW-VOLTAGE TRANSFORMERS**

- M. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.
- N. Where not factory-installed, install lugs sized as required for termination of conductors as shown on the drawings.
- O. Where furnished as a separate accessory, install transformer weathershield per manufacturer's instructions.
- P. Identify transformers in accordance with Section 26 05 53.

**3.3. FIELD QUALITY CONTROL**

- A. Perform field inspection, testing, and adjusting in accordance with Section 01 40 00.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS Sections 7.2.1.1 and 7.2.1.2. Tests and inspections listed as optional are not required.
  - 1. 167 kVA single phase, 500 kVA three phase and smaller:
    - a. Perform turns ratio tests at all tap positions.
  - 2. Larger than 167 kVA single phase and 500 kVA three phase:
    - a. Verify that control and alarm settings on temperature indicators are as specified.
    - b. Perform excitation-current tests on each phase.
    - c. Measure the resistance of each winding at each tap connection.
    - d. Perform an applied voltage test on all high- and low-voltage windings-to-ground.

**3.4. ADJUSTING**

- A. Measure primary and secondary voltages and make appropriate tap adjustments.
- B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

**3.5. CLEANING**

- A. Clean dirt and debris from transformer components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

**END OF SECTION**

**SWITCHBOARDS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Switchboards.
- B. Metering transformer cabinets.
- C. Meter bases.

**1.2. RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete for supporting foundations and pads.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.

**1.3. REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.
- C. NEMA PB 2 - Deadfront Distribution Switchboards; 2011.
- D. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less; 2013.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 891 - Standard for Safety Switchboards; Underwriters Laboratories, Inc.; 2005.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.
- C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; and switchboard instrument details.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual locations of switchboards.
- F. Maintenance Data: Recommended maintenance procedures and intervals.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Enclosure Keys: Two of each different key.

**1.5. QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.



**SWITCHBOARDS**

- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section.
- C. Perform work in accordance with utility company written requirements and NFPA 70.
  - 1. Maintain one copy of each document on site.
- D. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

**1.6. DELIVERY, STORAGE, AND HANDLING**

- A. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

**PART 2 PRODUCTS****2.1. MANUFACTURERS**

- A. Eaton Electrical: [www.eatonelectrical.com](http://www.eatonelectrical.com).
- B. General Electric Company: [www.geindustrial.com](http://www.geindustrial.com).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us).
- D. Siemens: [www.sea.siemens.com](http://www.sea.siemens.com).

**2.2. SWITCHBOARDS**

- A. Description: NEMA PB 2 switchboard with electrical ratings and configurations as indicated and specified.
- B. Ratings:
  - 1. Voltage and bus ampacity rating: As indicated on drawings.
  - 2. Integrated Equipment Rating: Rating shall exceed available utility fault current.
  - 3. Main service board shall be service entrance rated.
- C. Bus Material: Copper or aluminum with tin plating, standard size.
- D. Bus Connections: Bolted, accessible from front for maintenance.
- E. Ground Bus: Extend length of switchboard.
- F. Insulated Ground Bus: Extend length of switchboard.
- G. Fusible Switch Assemblies: NEMA KS 1, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lock in OFF position. Fuse clips: Designed to accommodate Class R or Class J fuses, type as specified.
- H. Fusible Switch Assemblies, 800 Amperes and Larger: Bolted pressure contact switches. Fuse clips: Designed to accommodate Class L fuses.

**SWITCHBOARDS**

- I. Molded Case Circuit Breakers: Integral thermal and instantaneous magnetic trip in each pole.
  - 1. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
  - 2. Include shunt trip where indicated.
- J. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.
- K. Metering Transformer Compartment: For utility company's use; compartment size, bus spacing and drilling, door, and locking and sealing requirements in accordance with utility company's requirements.
- L. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.
- M. Pull Box: Removable top and sides, same construction as switchboard.
  - 1. Size as shown on Drawings.
  - 2. Set front back sufficient distance to accommodate circuit breaker lifting devices.
  - 3. Provide insulating, fire-resistive bottom with separate openings for each circuit to pass into switchboard.
- N. Enclosure: Type 1 - General Purpose.
  - 1. Align sections at rear only.
  - 2. Switchboard Height: 90 inches, excluding floor sills, lifting members and pull boxes.
  - 3. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

**2.3. COMPONENTS**

- A. Metering Transformer Cabinets: Sheet metal cabinet with hinged door, conforming to utility company requirements, with provisions for locking and sealing.
  - 1. Size: As required by utility.
- B. Meter Base: As required by utility company.
- C. Provide a voltage and KW demand digital meter for each switchboard.
- D. Provide external TVSS devices for each switchboard.

**2.4. SOURCE QUALITY CONTROL**

- A. Shop inspect and test switchboard according to NEMA PB 2.

**PART 3 EXECUTION****3.1. PREPARATION**

- A. Provide concrete housekeeping pad under the provisions of Section 03 30 00.
- B. Arrange with utility company to obtain permanent electric service to the Project.

**SWITCHBOARDS**

- C. Verify that field measurements are as instructed by manufacturer and as indicated on utility company drawings.

**3.2. INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
- C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
- D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.
- E. Provide required support and attachment components in accordance with Section 26 05 29.
- F. Install switchboards plumb and level.
- G. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00.
- H. Provide grounding and bonding in accordance with Section 26 05 26.
- I. Install all field-installed devices, components, and accessories.
- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Provide filler plates to cover unused spaces in switchboards.
- L. Install switchboard in locations shown on drawings, according to NEMA PB 2.1.
- M. Install transformer pad and/or vault, metering transformer cabinets, and meter base as required by utility company.
- N. Install in a neat and workmanlike manner, as specified in NECA 400.
- O. Tighten accessible bus connections and mechanical fasteners after placing switchboard.
- P. Install fuses in each switch.

**3.3. FIELD QUALITY CONTROL**

- A. Perform field testing in accordance with Section 01 40 00.

**3.4. ADJUSTING**

- A. Adjust all operating mechanisms for free mechanical movement.
- B. Tighten bolted bus connections in accordance with manufacturer's instructions.
- C. For systems with adjustable trip circuit breakers, provide coordination study for review. Adjust circuit breaker trip and time delay settings to values indicated on coordination study. Submit to Architect for review.

**3.5. CLEANING**

- A. Touch up scratched or marred surfaces to match original finish.

**END OF SECTION**

**PANELBOARDS****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Power distribution panelboards.
- B. Overcurrent protective devices for panelboards.

**1.2. RELATED REQUIREMENTS**

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

**1.3. REFERENCE STANDARDS**

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision E, 2013.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2009.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- E. NEMA PB 1 - Panelboards; 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.
- G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- K. UL 67 - Panelboards; Current Edition, Including All Revisions.
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- M. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.
- N. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
- O. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.
- P. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

**1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:

**PANELBOARDS**

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

**1.5. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
- D. Field Quality Control Test Reports.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Panelboard Keys: One for each panelboard installed.

**1.6. QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section.

**1.7. DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

**PANELBOARDS**

- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

**1.8. FIELD CONDITIONS**

- A. Maintain ambient temperature within the following limits during and after installation of panelboards:
  - 1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

**PART 2 PRODUCTS****2.1. MANUFACTURERS**

- A. Eaton Corporation; Cutler-Hammer Products: [www.eaton.com](http://www.eaton.com).
- B. General Electric Company: [www.geindustrial.com](http://www.geindustrial.com).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us).
- D. Siemens.
- E. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

**2.2. ALL PANELBOARDS**

- A. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose indicated.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet.
  - 2. Ambient Temperature:
    - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- C. Short Circuit Current Rating:
  - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location.
  - 2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70, acceptable only where specifically indicated, or not acceptable.
  - 3. Label equipment utilizing series ratings as required by NFPA 70.
- D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- E. All panelboards shall have door-in-door type front covers

**PANELBOARDS**

- F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
  - 1. Provide fully rated neutral bus, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
  - 2. Provide 200 percent rated neutral bus and lugs where oversized neutral conductors are provided.
  - 3. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
  - 4. Provide separate isolated/insulated ground bus where indicated.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
  - 2. Boxes: Galvanized steel unless otherwise indicated.
    - a. Provide wiring gutters sized to accommodate the conductors to be installed.
    - b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
    - c. Provide removable end walls for NEMA Type 1 enclosures.
    - d. Provide painted steel boxes for surface-mounted panelboards, finish to match fronts.
  - 3. Fronts:
    - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
    - b. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
  - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- K. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
  - 1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
  - 2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
    - a. Use zero sequence ground fault detection method unless otherwise indicated.
    - b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
- L. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- M. Provide the following features and accessories where indicated or where required to complete installation:



**PANELBOARDS**

1. Feed-through lugs.
2. Main breaker.
3. Double lugs.

**2.3. POWER DISTRIBUTION PANELBOARDS**

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
  1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  2. Main and Neutral Lug Type: Compression.
- C. Bussing:
  1. Phase and Neutral Bus Material: Aluminum or copper.
  2. Ground Bus Material: Copper.
- D. Circuit Breakers:
  1. Provide bolt on type.
  2. Provide thermal magnetic circuit breakers unless otherwise indicated.
- E. Enclosures:
  1. Provide surface-mounted enclosures as indicated.
  2. Fronts: Provide trims to cover access to load terminals, wiring gutters, and other live parts, with exposed access to overcurrent protective device handles.

**2.4. OVERCURRENT PROTECTIVE DEVICES**

- A. Molded Case Circuit Breakers:
  1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
  2. Interrupting Capacity:
    - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      1. 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      2. 14,000 rms symmetrical amperes at 480 VAC.
    - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
    - c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
  3. Conductor Terminations:
    - a. Provide mechanical lugs for circuit breaker frame sizes less than 400 amperes.
    - b. Provide compression lugs for circuit breaker frame sizes 400 amperes and above.



**PANELBOARDS**

- c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors of full breaker ampacity rating.
- 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
  - a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
  - b. Provide interchangeable trip units for circuit breaker frame sizes 400 amperes and larger.
- 5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
- 6. Provide the following circuit breaker types where indicated:
  - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
  - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
  - c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699. Provide where required by applicable code.
- 7. Provide listed switching duty rated circuit breakers with SWD marking for all branch circuits serving lighting.
- 8. Provide listed high intensity discharge lighting rated circuit breakers with HID marking for all branch circuits serving HID lighting.
- 9. Do not use tandem circuit breakers.
- 10. Do not use handle ties in lieu of multi-pole circuit breakers.

**2.5. SOURCE QUALITY CONTROL**

- A. Factory test panelboards according to NEMA PB 1.

**PART 3 EXECUTION****3.1. EXAMINATION**

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

**3.2. INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install panelboards securely, in a neat and workmanlike manner in accordance with NECA 1 (general workmanship), NECA 407 (panelboards), and NEMA PB 1.1.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

**PANELBOARDS**

- D. Provide required supports in accordance with Section 26 05 29.
- E. Install panelboards plumb.
- F. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- G. Mount panelboards such that the top of panelboard is 6 feet 6 inches above the floor or working platform. Install panelboards taller than 6 feet with bottom no more than 4 inches above the floor.
- H. Mount floor-mounted power distribution panelboards on properly sized 3 inch or 4 inch high concrete pad constructed in accordance with Section 03 30 00.
- I. Provide spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling.
  - 1. 1 empty 1 inch for every 6 spare breaker pole spaces and spare breakers.
- J. Provide grounding and bonding in accordance with Section 26 05 26.
  - 1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
  - 2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.
- K. Install all field-installed branch devices, components, and accessories.
- L. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- M. Set field-adjustable circuit breaker tripping function settings as required.
- N. Set field-adjustable ground fault protection pickup and time delay settings as required.
- O. Provide filler plates to cover unused spaces in panelboards.
- P. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
  - 1. Emergency and night lighting circuits.
  - 2. Fire detection and alarm circuits.
  - 3. Communications equipment circuits.
  - 4. Intrusion detection and access control system circuits.
  - 5. Video surveillance system circuits.
- Q. Identify panelboards in accordance with Section 26 05 53.
- R. Provide computer-generated circuit directory for each lighting and appliance panelboard and each power distribution panelboard provided with a door, clearly and specifically indicating the loads served. Identify spares and spaces.
- S. Provide minimum four (4) spares and four (4) spaces per 42-circuit panelboard.

**3.3. FIELD QUALITY CONTROL**

- A. Perform inspection, testing, and adjusting in accordance with Section 01 40 00.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 800 amperes. Tests listed as optional are not required.
  - 1. Perform insulation-resistance tests on all control wiring with respect to ground.
  - 2. Test functions of the trip unit by means of secondary injection.

**PANELBOARDS**

- D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
  - 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
- E. Test GFCI circuit breakers to verify proper operation.
- F. Test AFCI circuit breakers to verify proper operation.
- G. Test shunt trips to verify proper operation.
- H. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.
- I. Correct deficiencies and replace damaged or defective panelboards or associated components.

**3.4. ADJUSTING**

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

**3.5. CLEANING**

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Electrical connections to equipment.

**1.2. RELATED REQUIREMENTS**

- A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- B. Section 26 05 34 - Conduit.
- C. Section 26 05 37 - Boxes.
- D. Section 26 27 26 - Wiring Devices.
- E. Section 26 28 16.16 - Enclosed Switches.

**1.3. REFERENCE STANDARDS**

- A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).
- B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
  - 2. Determine connection locations and requirements.
  - 3. Conduit, wire and circuit breaker sizes for mechanical equipment and equipment furnished under other Divisions are based on the equipment ratings of one manufacturer. The equipment actually furnished may have different electrical characteristics. Conduit, wire, and circuit breakers shall not be ordered or installed until exact electrical requirements are obtained. Responsibility for this coordination shall rest with the Contractor.
  - 4. Verify special purpose outlet NEMA configuration and ampere rating with equipment supplier prior to ordering devices and coverplates.
- B. Sequencing:
  - 1. Install rough-in of electrical connections before installation of equipment is required.
  - 2. Make electrical connections before required start-up of equipment.

**1.5. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.

- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

**1.6. QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

**PART 2 PRODUCTS**

**2.1. MATERIALS**

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
  - 1. Colors: Conform to NEMA WD 1.
  - 2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
  - 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
- B. Enclosed Switches: As specified in Section 26 2818.
- C. Wiring Devices: As specified in Section 26 27 26.
- D. Flexible Conduit: As specified in Section 26 05 34.
- E. Wire and Cable: As specified in Section 26 05 19.
- F. Boxes: As specified in Section 26 05 37.

**2.2. EQUIPMENT CONNECTIONS**

- A. As indicated on Drawings

**PART 3 EXECUTION**

**3.1. EXAMINATION**

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

**3.2. ELECTRICAL CONNECTIONS**

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.

**EQUIPMENT WIRING**

- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.
- J. All equipment is to be grounded with equipment grounding conductor per NEC requirements.
- K. Provide conduit for low voltage control cables/conductors.

**END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Wall switches.
- B. Wall dimmers.
- C. Fan speed controllers.
- D. Receptacles.
- E. Wall plates.
- F. Occupancy sensors.

**1.2. RELATED REQUIREMENTS**

- A. Section 26 05 33.23 - Surface Raceways: Surface raceway systems, including multioutlet assemblies.
- B. Section 26 05 37 - Boxes.
- C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 27 17 - Equipment Wiring: Cords and plugs for equipment.

**1.3. REFERENCE STANDARDS**

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
- I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
- L. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.
- M. UL 1917 - Solid-State Fan Speed Controls; Current Edition, Including All Revisions.

**1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
  - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.

3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
  4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
  5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
  6. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.
- B. Sequencing:
1. Do not install wiring devices until final surface finishes and painting are complete.

### **1.5. SUBMITTALS**

- A. See Section 01 60 00 - Submittal Procedures, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
1. Wall Dimmers: Include derating information for ganged multiple devices.
- C. Samples: One for each type and color of device and wall plate specified, if requested.
- D. Field Quality Control Test Reports.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Operation and Maintenance Data:
1. Wall Dimmers: Include information on operation and setting of presets.
  2. GFI Receptacles: Include information on status indicators and testing procedures and intervals.
- G. Project Record Documents: Record actual installed locations of wiring devices.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
  3. Extra Keys for Locking Switches: Five of each type.

### **1.6. QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

### **1.7. DELIVERY, STORAGE, AND PROTECTION**

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.



**PART 2 PRODUCTS**

**2.1. MANUFACTURERS**

- A. Hubbell Incorporated: [www.hubbell-wiring.com](http://www.hubbell-wiring.com). Part numbers indicated are Hubbell; equals by other manufacturers are acceptable, unless otherwise noted.
- B. Leviton Manufacturing Company, Inc.: [www.leviton.com](http://www.leviton.com).
- C. Lutron Electronics Company, Inc.: [www.lutron.com](http://www.lutron.com).
- D. Pass & Seymour, a brand of Legrand North America, Inc.: [www.legrand.us](http://www.legrand.us)
- E. Cooper Wiring Devices: [www.cooperwiringdevices.com](http://www.cooperwiringdevices.com).
- F. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Source Limitations: Where possible, for each type of wiring device furnish products produced by a single manufacturer and obtained from a single supplier.

**2.2. APPLICATIONS**

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFI receptacles with specified weatherproof covers for all receptacles installed outdoors or in damp or wet locations.
- D. Provide tamper resistant receptacles for all receptacles installed in dwelling units.
- E. Provide GFI protection for all receptacles installed within 6 feet of sinks.
- F. Provide GFI protection for all receptacles installed to serve the countertop surfaces in residential kitchens and all 15A and 20A, 125V receptacles in non-dwelling type kitchens.
- G. Provide GFI protection for all receptacles serving electric drinking fountains.
- H. Unless noted otherwise, do not use combination switch/receptacle devices.
- I. For flush floor service fittings, use tile rings for installations in tile floors.
- J. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

**2.3. ALL WIRING DEVICES**

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- B. Finishes:
  - 1. All Wiring Devices: Color as selected by Architect with wall plate as specified in wall plates section, unless otherwise indicated.
  - 2. Wiring Devices Installed in Finished Spaces: Color as selected by Architect with wall plate as specified in wall plates section, unless otherwise indicated.
  - 3. Wiring Devices Installed in Unfinished Spaces: Color as selected by Architect with wall plate as specified in wall plates section, unless otherwise indicated.
  - 4. Wiring Devices Installed in Wet or Damp Locations: Color as selected by Architect, with specified weatherproof cover unless otherwise indicated.

## **2.4. WALL SWITCHES**

- A. Manufacturers:
1. Hubbell Incorporated: [www.hubbell-wiring.com](http://www.hubbell-wiring.com). Part numbers indicated are Hubbell; equals by other manufacturers are acceptable, unless otherwise noted.
  2. Leviton Manufacturing Company, Inc.: [www.leviton.com](http://www.leviton.com).
  3. Pass & Seymour, a brand of Legrand North America, Inc.: [www.legrand.us](http://www.legrand.us)
  4. Cooper Wiring Devices: [www.cooperwiringdevices.com](http://www.cooperwiringdevices.com).
  5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; switch type as indicated on the drawings.
- C. Residential Wall Switches: Residential specification grade, 15A, 120V with standard toggle type switch actuator and maintained contacts; switch type as indicated on the drawings.

## **2.5. WALL DIMMERS**

- A. Manufacturers:
1. Leviton Manufacturing Company, Inc.: [www.leviton.com](http://www.leviton.com).
  2. Lutron Electronics Company, Inc.: [www.lutron.com](http://www.lutron.com). Part numbers indicated are Lutron; equals by other manufacturers are acceptable, unless otherwise noted.
  3. Pass & Seymour, a brand of Legrand North America, Inc.: [www.legrand.us](http://www.legrand.us)
  4. Hubbell Incorporated: [www.hubbell-wiring.com](http://www.hubbell-wiring.com).
  5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. All Wall Dimmers: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.
- C. Incandescent Wall Dimmers: 120 V AC, slide control type with separate on/off switch; single pole or three way as indicated on the drawings.
1. Power Rating: Match load indicated on the drawings; 1000 watts minimum.
  2. Provide locator light, illuminated with load off.
  3. Products:
    - a. Lutron Skylark Series or approved equal.
- D. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

## **2.6. FAN SPEED CONTROLLERS**

- A. Manufacturers:
1. Leviton Manufacturing Company, Inc.: [www.leviton.com](http://www.leviton.com).
  2. Lutron Electronics Company, Inc.: [www.lutron.com](http://www.lutron.com). Part numbers indicated are Lutron; equals by other manufacturers are acceptable, unless otherwise noted.

**WIRING DEVICES**

3. Pass & Seymour, a brand of Legrand North America, Inc.: [www.legrand.us](http://www.legrand.us)
  4. Hubbell Incorporated: [www.hubbell-wiring.com](http://www.hubbell-wiring.com).
  5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: 120 V AC, solid-state, three speed, slide control type with slide on/off control, with integral radio frequency interference filtering, fan hum elimination circuitry, power failure preset memory, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1917.
1. Current Rating: 1.5 A unless otherwise indicated or required to control the load indicated on the drawings.
  2. Products:
    - a. Lutron Skylark Series or approved equal.

**2.7. RECEPTACLES**

- A. Manufacturers:
1. Hubbell Incorporated: [www.hubbell-wiring.com](http://www.hubbell-wiring.com).
  2. Leviton Manufacturing Company, Inc.: [www.leviton.com](http://www.leviton.com).
  3. Pass & Seymour, a brand of Legrand North America, Inc.: [www.legrand.us](http://www.legrand.us)
  4. Cooper Wiring Devices: [www.cooperwiringdevices.com](http://www.cooperwiringdevices.com).
  5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. All Receptacles: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
  2. NEMA configurations specified are according to NEMA WD 6.
- C. Convenience Receptacles:
1. Standard Convenience Receptacles in Commercial Areas: Commercial specification grade, 20A, 125V, NEMA 5-20R and/or 15A, 125V, NEMA 5-15R; type as indicated on the drawings.
  2. Standard Convenience Receptacles in Residential Areas: Residential grade, 20A, 125V, NEMA 5-20R and/or 15A, 125V, NEMA 5-15R; type as indicated on the drawings.
  3. Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R and/or 15A, 125V, NEMA 5-15R, , listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; type as indicated on the drawings.
  4. Tamper Resistant Convenience Receptacles: Residential grade, 20A, 125V, NEMA 5-20R and/or 15A, 125V, NEMA 5-15R, , listed and labeled as tamper resistant type; type as indicated on the drawings.
  5. Tamper Resistant and Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R and/or 15A, 125V, NEMA 5-15R, , listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; type as indicated on the drawings.

- D. GFI Receptacles:
1. All GFI Receptacles: Provide with feed-through protection, light to indicate ground fault tripped condition and loss of protection, and list as complying with UL 943, class A.
    - a. Provide test and reset buttons of same color as device.
  2. Standard GFI Receptacles: Residential grade, duplex, 20A, 125V, NEMA 5-20R and/or 15A, 125V, NEMA 5-15R.
  3. Weather Resistant GFI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R and/or 15A, 125V, NEMA 5-15R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
  4. Tamper Resistant GFI Receptacles: Residential grade, duplex, 20A, 125V, NEMA 5-20R and/or 15A, 125V, NEMA 5-15R, listed and labeled as tamper resistant type.
  5. Tamper Resistant and Weather Resistant GFI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R and/or 15A, 125V, NEMA 5-15R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
- E. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.
1. Standard Locking Convenience Receptacles: Single, 20A, 125V, NEMA L5-20R.

## **2.8. WALL PLATES**

- A. Manufacturers:
1. Hubbell Incorporated: [www.hubbell-wiring.com](http://www.hubbell-wiring.com).
  2. Leviton Manufacturing Company, Inc.: [www.leviton.com](http://www.leviton.com).
  3. Pass & Seymour, a brand of Legrand North America, Inc.: [www.legrand.us](http://www.legrand.us)
  4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. All Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
  2. Size: Standard.
  3. Screws: Metal with slotted heads finished to match wall plate finish.
  4. Provide screwless wallplates with concealed mounting hardware where indicated.
- C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- D. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- E. Weatherproof Covers for Wet or Damp Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected. Hubbell WP26M Series.

## **2.9. OCCUPANCY SENSORS**

- A. Manufacturers:

**WIRING DEVICES**

1. Wattstopper: [www.wattstopper.com](http://www.wattstopper.com). Part numbers indicated are Wattstopper; equals by other manufacturers are acceptable, unless otherwise noted.
  2. Hubbell Incorporated: [www.hubbell-wiring.com](http://www.hubbell-wiring.com).
  3. Sensor Switch: [www.sensorswitch.com](http://www.sensorswitch.com).
  4. Greengate: [www.cooperindustries.com](http://www.cooperindustries.com).
  5. Lutron Electronics Company, Inc.: [www.lutron.com](http://www.lutron.com).
  6. Leviton Manufacturing Company, Inc.: [www.leviton.com](http://www.leviton.com).
  7. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Sensors to be dual technology type with integral 24-volt dry contact for use with energy management system, unless otherwise indicated.
- C. Sensors to have manual-on operation.
- D. Sensors to be provided with coverage pattern and mounting as shown on drawings.
- E. The drawings show approximate locations of detectors and are diagrammatic only. Exact locations of detectors are to be field verified with the factory representative prior to mounting.
- F. Provide power pack as required for low voltage occupancy sensors. Wattstopper BZ-150 Series.
- G. Wall Switch:
1. Dual Technology: Wattstopper DW-100 Series.
    - a. Coverage area up to 1,000 sq. ft. with 180 degrees field of view.
  2. Passive Infrared: Wattstopper WS-250 Series.
    - a. Coverage area up to 900 sq. ft. with 180 degrees field of view.
  3. Ultrasonic: Wattstopper UW-100 Series.
    - a. Coverage area up to 400 sq. ft. with 180 degrees field of view.
- H. Ceiling Mount (360 degrees):
1. Dual Technology: Wattstopper DT-300 Series.
    - a. Coverage area up to 1,000 sq. ft. with 360 degrees field of view.
  2. Passive Infrared: Wattstopper CI-300 Series.
    - a. Coverage area up to 1,200 sq. ft. with 360 degrees field of view.
  3. Ultrasonic: Wattstopper VT300-3 Series.
    - a. Coverage area up to 2,000 sq. ft. with 360 degrees field of view.
- I. Ceiling/Wall Mount (Directional):
1. Dual Technology: Wattstopper DT-200 Series.
    - a. Coverage area up to 2,000 sq. ft..
  2. Passive Infrared: Wattstopper CX-100 Series.
    - a. Coverage area up to 1,000 sq. ft.

**PART 3 EXECUTION****3.1. EXAMINATION**

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

**WIRING DEVICES**

- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that floor boxes are adjusted properly.
- F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- G. Verify that openings in access floor are in proper locations.
- H. Verify that conditions are satisfactory for installation prior to starting work.

**3.2. PREPARATION**

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

**3.3. INSTALLATION**

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of wiring devices provided under this section.
  - 1. Mounting Heights: As indicated on the drawings.
  - 2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
  - 3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
  - 4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
  - 5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal or inserting conductor screw-actuated in binding clamp and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- F. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- G. Unless otherwise indicated, GFI receptacles may be connected to provide feed-through protection to downstream devices. Label such devices to indicate they are protected by upstream GFI protection.
- H. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.
- I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

**WIRING DEVICES**

- J. Install wall switches with OFF position down.
- K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- L. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on right.
- M. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- N. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

**3.4. FIELD QUALITY CONTROL**

- A. Perform field inspection, testing, and adjusting in accordance with Section 01 40 00.
- B. Inspect each wiring device for damage and defects.
- C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- D. Test each receptacle to verify operation and proper polarity.
- E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- F. Correct wiring deficiencies and replace damaged or defective wiring devices.

**3.5. ADJUSTING**

- A. Adjust devices and wall plates to be flush and level.

**3.6. CLEANING**

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

**END OF SECTION**



**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Fuses.
- B. Circuit breakers.

**1.2. REFERENCE STANDARDS**

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.3. SUBMITTALS**

- A. See Section 01 60 00 - Submittal Procedures, for submittal procedures.
- B. Product Data: Provide data sheets showing electrical characteristics, including time-current curves.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Fuses: Three of each type and size.
  - 3. Fuse Pullers: Two.

**1.4. QUALITY ASSURANCE**

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

**PART 2 PRODUCTS**

**2.1. MANUFACTURERS**

- A. Fuses:
  - 1. Bussmann, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com).
  - 2. Ferraz Shawmut, Inc.: [www.ferrazshawmut.com](http://www.ferrazshawmut.com).
  - 3. Littelfuse, Inc: [www.littelfuse.com](http://www.littelfuse.com).
- B. Circuit Breakers:
  - 1. Eaton Corporation; Cutler-Hammer Products: [www.eaton.com](http://www.eaton.com).
  - 2. General Electric Company: [www.geindustrial.com](http://www.geindustrial.com).
  - 3. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us).
  - 4. Siemens: [www.sea.siemens.com](http://www.sea.siemens.com).



**2.2. FUSES - GENERAL**

- A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.
- B. Voltage: Rating suitable for circuit phase-to-phase voltage.
- C. Main Service Switches Larger than 600 amperes: Class L (time delay).
- D. Main Service Switches: Class RK1 (time delay).
- E. Power Load Feeder Switches Larger than 600 amperes: Class L (time delay).
- F. Power Load Feeder Switches: Class RK1 (time delay) or J (time delay).
- G. Motor Load Feeder Switches: Class RK1 (time delay) or J (time delay).

**2.3. CLASS RK1 (TIME DELAY) FUSES**

- A. Manufacturers:
  - 1. Bussmann LPS-RK (600V) or LPN-RK (250V): [www.bussmann.com](http://www.bussmann.com).
  - 2. Ferraz Shawmut: [www.ferrazshawmut.com](http://www.ferrazshawmut.com).
  - 3. Littelfuse: [www.littelfuse.com](http://www.littelfuse.com).

**2.4. CLASS J (TIME DELAY) FUSES**

- A. Manufacturers:
  - 1. Bussmann LPJ-SP: [www.bussmann.com](http://www.bussmann.com).
  - 2. Ferraz Shawmut: [www.ferrazshawmut.com](http://www.ferrazshawmut.com).
  - 3. Littelfuse: [www.littelfuse.com](http://www.littelfuse.com).

**2.5. CLASS L (TIME DELAY) FUSES**

- A. Manufacturers:
  - 1. Bussmann KRP-C: [www.bussmann.com](http://www.bussmann.com).
  - 2. Ferraz Shawmut: [www.ferrazshawmut.com](http://www.ferrazshawmut.com).
  - 3. Littelfuse: [www.littelfuse.com](http://www.littelfuse.com).

**2.6. CIRCUIT BREAKERS**

- A. Circuit breakers shall be molded case, bolt-on, trip free, quick make, quick break, thermal magnetic type.
- B. Circuit breakers shall be calibrated to carry 80% rated current in an ambient temperature of 40 degrees C.
- C. Handles shall clearly indicate rating and position "On", "Off", or "Tripped".
- D. Multi-pole circuit breakers shall be common trip such that an overload or short circuit on any one pole will result in all poles opening simultaneously.
- E. Circuit breakers shall have an interrupting rating not less than the available fault duty at the breaker. Minimum rating shall be 10,000A for 250 volt panels. Circuit breakers shall be fully rated to exceed the available 3 phase fault current.
- F. Circuit breakers shall be switch duty rated and full size, tandem units are not approved.

**FUSES AND CIRCUIT BREAKERS**

- G. Provide with handle "lock-on" device for breakers serving time switches, night lights, emergency lighting unit equipment, fire alarm, security, data racks, servers, and other circuits as identified on the drawings.
- H. Provide combination circuit breakers and ground fault interrupters where indicated on the drawings or required by the National Electrical Code.
- I. All circuit breakers rated 250A and above shall be provided with adjustable magnetic trip elements.
- J. Circuit breakers shall conform to NEMA standard AB1.
- K. Provide products suitable for use as service entrance equipment where applicable.

**PART 3 EXECUTION****3.1. INSTALLATION**

- A. Install fuses with label oriented such that manufacturer, type, and size are easily read.
- B. Install enclosed circuit breakers where indicated, in accordance with manufacturer's instructions.
- C. Install enclosed circuit breakers plumb. Provide support and labeling in accordance with these specifications.
- D. In dwelling areas, as required by NEC 210.12, provide arc-fault circuit breakers to protect all branch circuits such that the complete circuit is protected.

**3.2. FIELD QUALITY CONTROL**

- A. Perform field inspection and testing in accordance with Section 01 4000.
- B. Inspect and test each circuit breaker.
- C. Inspect each circuit breaker visually.
- D. Perform several mechanical ON-OFF operations on each circuit breaker.
- E. Verify circuit continuity on each pole in closed position.
- F. Determine that circuit breaker will trip on overcurrent condition, with tripping time to NEMA AB 1 requirements.
- G. Include description of testing and results in test report.

**3.3. ADJUSTING**

- A. Adjust trip settings so that circuit breakers coordinate with other overcurrent protective devices in circuit.
- B. Adjust trip settings to provide adequate protection from overcurrent and fault currents.

**END OF SECTION**

**PART 1 - GENERAL**

**1.1. SECTION INCLUDES**

- A. Automatic transfer switch.

**1.2. RELATED SECTIONS**

- A. Section 26 32 13 - Packaged Propane Vapor Generator: Testing requirements.

**1.3. REFERENCES**

- A. NFPA 70 - National Electrical Code.
- B. NEMA ICS 1 - General Standards for Industrial Control and Systems.
- C. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies.
- D. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- E. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

**1.4. SUBMITTALS**

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Provide catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, dimensions, and enclosure details.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

**1.5. OPERATION AND MAINTENANCE DATA**

- A. Submit under provisions of Section 01 78 23.
- B. Operation Data: Include instructions for operating equipment. Include instructions for operating equipment under emergency conditions when engine generator is running.
- C. Maintenance Data: Include routine preventative maintenance and lubrication schedule. List special tools, maintenance materials, and replacement parts.

**1.6. QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience, and with service facilities within 50 miles of Project.
- B. Supplier: Authorized distributor of specified manufacturer with minimum three years experience.

**1.7. REGULATORY REQUIREMENTS**

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

**1.8. DELIVERY, STORAGE, AND HANDLING**

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to internal components, enclosure and finish.

**1.9. FIELD MEASUREMENTS**

- A. Verify that field measurements are as indicated on shop drawings.

**1.10. MAINTENANCE SERVICE**

- A. Furnish service and maintenance of transfer switch for one year from Date of Substantial Completion.

**1.11. MAINTENANCE MATERIALS**

- A. Provide maintenance materials under provisions of Section 01 78 23.
- B. Provide two of each special tool required for maintenance.

**PART 2 - PRODUCTS**

**2.1. MANUFACTURERS**

- A. ONAN.
- B. Pacific Detroit Diesel.
- C. CATERPILLAR.
- D. ASCO.
- E. Katolight.

**2.2. AUTOMATIC TRANSFER SWITCH**

- A. Description: NEMA ICS 2, automatic transfer switch.
- B. Configuration: Electrically operated, mechanically held transfer switch.
- C. Open Transition.

**ENCLOSED TRANSFER SWITCHES****2.3. SERVICE CONDITIONS**

- A. Service Conditions: NEMA ICS 1.
- B. Temperature: 90 degrees F.
- C. Altitude: 1000 feet.

**2.4. RATINGS**

- A. Voltage: As noted on drawings.
- B. Switched Poles: 3.
- C. Load Inrush Rating: Combination.
- D. Continuous Rating: As noted on drawings.
- E. Interrupting Capacity: 100 percent of continuous rating.
- F. Withstand Current Rating: Shall meet or exceed available 3 phase fault current.

**2.5. PRODUCT OPTIONS AND FEATURES**

- A. Indicating Lights: Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, SWITCH POSITION.
- B. Test Switch: Mount in cover of enclosure to simulate failure of normal source.
- C. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate to normal source.
- D. Transfer Switch Auxiliary Contacts: 1 normally open; 1 normally closed.
- E. Normal Source Monitor: Monitor each line of normal source voltage and frequency; initiate transfer when voltage drops below 85 percent or frequency varies more than 3 percent from rated nominal value.
- F. Alternate Source Monitor: Monitor alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 percent from rated nominal value.

**2.6. AUTOMATIC SEQUENCE OF OPERATION**

- A. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.
- B. Time Delay To Start Alternate Source Engine Generator: 0 to 30 seconds, adjustable.
- C. Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.
- D. Time Delay Before Transfer to Alternate Power Source: 0 to 30 seconds, adjustable.
- E. Initiate Retransfer Load to Normal Source: Upon permission by normal source monitor.
- F. Time Delay Before Transfer to Normal Power: 0 to 30 seconds, adjustable; bypass time delay in event of alternate source failure.
- G. Time Delay Before Engine Shut Down: 0 to 30 minutes, adjustable, of unloaded operation.
- H. Engine Exerciser: Start engine every 30 days; run for 30 minutes before shutting down. Bypass exerciser control if normal source fails during exercising period.

**ENCLOSED TRANSFER SWITCHES**

- I. Alternate System Exerciser: Transfer load to alternate source during engine exercising period.

**2.7. ENCLOSURE**

- A. Enclosure: ICS 6, Type 1.
- B. Finish: Manufacturer's standard enamel.

**PART 3 - EXECUTION (NOT USED)****END OF SECTION**

**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Packaged engine generator set.
- B. Engine mount radiator.
- C. Exhaust silencer and fittings.
- D. Fuel fittings and day tank.
- E. Fuel tank.
- F. Remote control panel.
- G. Battery and charger.
- H. Weatherproof enclosure.
- I. Remote fuel fill station.

**1.2. RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
- C. Section 22 0719 - Plumbing Piping Insulation.
- D. Section 23 11 13 - Facility Fuel-Oil Piping:
  - 1. Diesel fuel piping.
- E. Section 23 31 00 - HVAC Ducts and Casings.
- F. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- G. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- H. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- I. Section 26 36 00 - Transfer Switches.

**1.3. REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NECA/EGSA 404 - Standard for Installing Generator Sets; 2014.
- C. NEMA MG 1 - Motors and Generators; 2017.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2008.
- E. NFPA 30 - Flammable and Combustible Liquids Code; 2018.
- F. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines; 2015.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 99 - Health Care Facilities Code; 2015.
- I. NFPA 110 - Standard for Emergency and Standby Power Systems; 2013.
- J. UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids; Current Edition, Including All Revisions.
- K. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries; Current Edition, Including All Revisions.

- L. UL 2200 - Stationary Engine Generator Assemblies; Current Edition, Including All Revisions.

**1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
1. Coordinate compatibility of generator sets to be installed with work provided under other sections or by others.
  2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for engine generator system.
  3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  4. Coordinate the work to provide electrical circuits suitable for the power requirements of the actual auxiliary equipment and accessories to be installed.
  5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

**1.5. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Provide NFPA 110 required documentation from manufacturer where requested by authorities having jurisdiction, including but not limited to:
1. Certified prototype tests.
  2. Torsional vibration compatibility certification.
  3. NFPA 110 compliance certification.
  4. Certified rated load test at rated power factor.
- C. Shop Drawings: Indicate electrical characteristics and connection requirements. Show plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, electrical diagrams including schematic and interconnection diagrams.
- D. Product Data: Provide data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, day tank, remote radiator, remote fuel fill station, and weather proof enclosures.
- E. Test Reports: Indicate results of performance testing.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- G. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- H. Manufacturer's Field Reports: Indicate procedures and findings.
- I. Operation Data: Include instructions for normal operation.
- J. Maintenance Data: Include instructions for routine maintenance requirements, service manuals for engine and day tank, oil sampling and analysis for engine wear, and emergency maintenance procedures.



**ENGINE GENERATORS**

- K. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
1. Extra Filter Elements: Two of each type, including fuel, oil and air.
  2. Tools: One set of tools required for preventative maintenance of the engine generator system. Package tools in adequately sized metal tool box.

**1.6. QUALITY ASSURANCE**

- A. Comply with the following:
1. NFPA 70 (National Electrical Code).
  2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for Level 1 system.
  3. NFPA 101.
  4. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).
  5. NFPA 30 (Flammable and Combustible Liquids Code).
    - a. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- B. Products: Listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authorities having jurisdiction as suitable for the purpose indicated.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience with service facilities within 50 miles of Project.
- D. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years experience.
- E. Products: Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and indicated.

**1.7. DELIVERY, STORAGE, AND HANDLING**

- A. Accept unit on site on skids. Inspect for damage.
- B. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

**PART 2 PRODUCTS****2.1. MANUFACTURERS**

- A. Caterpillar Inc.: [www.caterpillar.com](http://www.caterpillar.com).
- B. Cummins : [www.cummins.com](http://www.cummins.com).
- C. Kohler: [www.kohler.com](http://www.kohler.com).

**2.2. PACKAGED ENGINE GENERATOR SYSTEM**

- A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. System Description:
  - 1. Application: Emergency/standby.
  - 2. Configuration: Single packaged engine generator set operated independently (not in parallel).
- C. Packaged Engine Generator Set:
  - 1. Type: Diesel (compression ignition).
  - 2. Power Rating: See One-Line Riser Diagram.
  - 3. Voltage: 277/480V 3 Phase.
- D. Generator Set General Requirements:
  - 1. Prototype tested in accordance with NFPA 110 for Level 1 systems.
  - 2. Factory-assembled, with components mounted on suitable base.
  - 3. List and label engine generator assembly as complying with UL 2200.
  - 4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
  - 5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.
- E. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the installed location.
- F. Starting and Load Acceptance Requirements:
  - 1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
  - 2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.
  - 3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 10 seconds (NFPA 110, Type 10).
  - 4. Maximum Load Step: Supports 100 percent of rated load in one step.
- G. Exhaust Emissions Requirements:
  - 1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.
  - 2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer and Engineer. Where such modifications are made, provide field emissions testing as necessary for certification.
- H. System Capacity: As indicated on drawings at elevation of 500 feet above sea level, standby rating using engine-mounted radiator.

**ENGINE GENERATORS****2.3. ENGINE AND ENGINE ACCESSORY EQUIPMENT**

- A. Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parasitic loads.
- B. Engine Fuel System - Diesel (Compression Ignition):
  - 1. Fuel Source: Diesel, ASTM D975 No. 2-D or approved cold weather diesel blends.
  - 2. Fuel Storage: Sub-base fuel tank.
  - 3. Engine Fuel Supply: Provide engine-driven, positive displacement fuel pump with replaceable fuel filter(s), water separator, check valve to secure prime, manual fuel priming pump, and relief-bypass valve. Provide fuel cooler where recommended by manufacturer.
  - 4. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
  - 5. Sub-Base Fuel Tank:
    - a. Provide sub-base mounted, double-wall fuel tank with secondary containment; listed and labeled as complying with UL 142.
    - b. Tank Capacity: Size for minimum of 24 hours of continuous engine generator operation at 100 percent rated load, but not larger than permissible by applicable codes.
    - c. Features:
      - 1. Direct reading fuel level gauge.
      - 2. Normal atmospheric vent.
      - 3. Emergency pressure relief vent.
      - 4. Fuel fill opening with lockable cap.
      - 5. Dedicated electrical conduit stub-up area.
- C. Engine Starting System:
  - 1. System Type: Electric, with DC solenoid-activated starting motor(s).
  - 2. Battery(s):
    - a. Battery Type: Lead-acid.
    - b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.
    - c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed.
  - 3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.
  - 4. Battery Charger:
    - a. Provide dual rate battery charger with automatic float and equalize charging modes and minimum rating of 10 amps; suitable for maintaining the supplied battery(s) at full charge without manual intervention.

**ENGINE GENERATORS**

- b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 24 hours, as required by NFPA 110 for Level 1 applications while carrying normal loads.
  - c. Recognized as complying with UL 1236.
  - d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.
  - e. Provide integral DC output ammeter and voltmeter with five percent accuracy.
  - f. Provide alarm output contacts as necessary for alarm indications.
- D. Engine Speed Control System (Governor):
  - 1. Single Engine Generator Sets (Not Operated in Parallel): Provide electronic isochronous governor for controlling engine speed/alternator frequency.
  - 2. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.
- E. Engine Lubrication System:
  - 1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dip-stick for oil level indication. Provide oil cooler where recommended by manufacturer.
- F. Engine Cooling System:
  - 1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.
  - 2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.
- G. Engine Air Intake and Exhaust System:
  - 1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.
  - 2. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.
- H. Governor: Isochronous type to maintain engine speed within 0.5 percent, steady state, and 5 percent, no load to full load, with recovery to steady state within 2 seconds following sudden load changes. .
- I. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F, and suitable for operation on 120 volts AC.
- J. Radiator: Radiator using glycol coolant, with blower type fan, sized to maintain safe engine temperature in ambient temperature of 110 degrees F. Radiator air flow restriction 0.5 inches of water maximum.

**2.4. ALTERNATOR (GENERATOR)**

- A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 1; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.
- B. Exciter:

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1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.
  2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.
  3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.
- C. Temperature Rise: Comply with UL 2200.
- D. Insulation System: NEMA MG 1, Class H; suitable for alternator temperature rise.
- E. Enclosure: NEMA MG 1, drip-proof.
- F. Total Harmonic Distortion: Not greater than five percent.
- G. Rating: kW as indicated on drawings, at 0.8 power factor, voltage as indicated on drawings, 60 Hz at 1800 rpm.

**2.5. GENERATOR SET CONTROL SYSTEM**

- A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.
- B. Control Panel:
1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
  2. Generator Set Control Functions:
    - a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).
    - b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
    - c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
    - d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset.
    - e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
    - f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).
    - g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.
  3. Generator Set Status Indications:
    - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
    - b. Current (Amps): For each phase.
    - c. Frequency (Hz).
    - d. Real power (W/kW).
    - e. Reactive power (VAR/kVAR).
    - f. Apparent power (VA/kVA).
    - g. Power factor.
    - h. Duty Level: Actual load as percentage of rated power.
    - i. Engine speed (RPM).

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- j. Battery voltage (Volts DC).
- k. Engine oil pressure.
- l. Engine coolant temperature.
- m. Engine run time.
- n. Generator powering load (position signal from transfer switch).
- 4. Generator Set Protection and Warning/Shutdown Indications:
  - a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following protections/indications:
    - 1. Overcrank (shutdown).
    - 2. Low coolant temperature (warning).
    - 3. High coolant temperature (warning).
    - 4. High coolant temperature (shutdown).
    - 5. Low oil pressure (shutdown).
    - 6. Overspeed (shutdown).
    - 7. Low fuel level (warning).
    - 8. Low coolant level (warning/shutdown).
    - 9. Generator control not in automatic mode (warning).
    - 10. High battery voltage (warning).
    - 11. Low cranking voltage (warning).
    - 12. Low battery voltage (warning).
    - 13. Battery charger failure (warning).
  - b. In addition to NFPA 110 requirements, provide the following protections/indications:
    - 1. High AC voltage (shutdown).
    - 2. Low AC voltage (shutdown).
    - 3. High frequency (shutdown).
    - 4. Low frequency (shutdown).
    - 5. Overcurrent (shutdown).
  - c. Provide contacts for local and remote common alarm.
  - d. Provide lamp test function that illuminates all indicator lamps.
- 5. Other Control Panel Features:
  - a. Event log.

**2.6. ACCESSORIES**

- A. Exhaust Silencer: Critical type silencer, with muffler companion flanges and flexible stainless steel exhaust fitting, sized in accordance with engine manufacturer's instructions.
- B. Battery Tray: Treated for electrolyte resistance, constructed to contain spillage.
- C. Line Circuit Breaker: Molded case circuit breaker on generator output with integral thermal and instantaneous magnetic trip in each pole, sized in accordance with NFPA 70; UL listed. Include battery-voltage operated shunt trip, connected to open circuit breaker on engine failure. Unit mount in enclosure to meet NEMA 250, Type 1 requirements. Coordinate with electrical system per NEC 700.28 and 701.27.

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- D. Remote Annunciator Panel: Flush mounted panel with painted finish. Provide alarm horn, and indicators and alarms as follows:
1. High battery voltage (alarm).
  2. Low battery voltage (alarm).
  3. Low fuel (alarm).
  4. System ready.
  5. Anticipatory-high water temperature.
  6. Anticipatory-low oil pressure.
  7. Low coolant temperature.
  8. Switch in off position (alarm).
  9. Overcrank (alarm).
  10. Emergency stop (alarm).
  11. High water temperature (alarm).
  12. Overspeed (alarm).
  13. Low oil pressure (alarm).
  14. Line power available.
  15. Generator power available.
  16. Lamp test and horn silence switch.
- E. Weather-Protective Enclosure: Sound attenuated, reinforced steel housing allowing access to control panel and service points, with lockable doors and panels. Include fixed louvers, battery rack, and silencer.
- F. Walk-In Enclosure: Pre-Fabricated, skid-mounted unit with engine generator, motorized air intake and exhaust louvers, controls, space heaters, and lighting fixtures. Provide 3 foot access aisle around engine-generator, with at least two doors for personnel access. Provide 7 feet clear height. Construct unit from insulated sheet metal panels to provide sound and thermal insulation.
- G. Remote Fuel Fill Station: Weather proof painted steel enclosure with hinged door(s), with 2" CAMLOCK, 2" Ball Valve, and 2" Check Valve. Provide 90% fuel level and 95% fuel level alarms wired to a 2: solenoid valve. Fuel fill station PRYCO 230 series.

**PART 3 EXECUTION****3.1. INSTALLATION**

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1.
- B. Install products in accordance with manufacturer's instructions.
- C. Install generator sets and associated accessories in accordance with NECA/EGSA 404.
- D. Arrange equipment to provide minimum clearances and required maintenance access.
- E. Unless otherwise indicated, mount generator set on properly sized 6 inch high concrete pad constructed in accordance with Section 03 30 00. Provide suitable vibration isolators, where not factory installed.
- F. Provide required support and attachment in accordance with Section 26 05 29.
- G. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.



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- H. Provide diesel fuel piping and venting in accordance with Section 23 21 13, where not factory installed.
- I. Provide engine exhaust piping in accordance with Section 23 51 00, where not factory installed.
  - 1. Include piping expansion joints, piping insulation, thimble, condensation trap/drain, rain cap, hangers/supports, etc. as indicated or as required.
  - 2. Do not exceed manufacturer's maximum back pressure requirements.
- J. Provide grounding and bonding in accordance with Section 26 05 26.
- K. Identify system wiring and components in accordance with Section 26 05 53.

**3.2. FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.
- C. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- D. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.
- E. Preliminary inspection and testing to include, at a minimum:
  - 1. Inspect each system component for damage and defects.
  - 2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
  - 3. Check for proper oil and coolant levels.
- F. Prepare and start system in accordance with manufacturer's instructions.
- G. Perform acceptance test in accordance with NFPA 110.
- H. Provide field emissions testing where necessary for certification.
- I. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.
- J. Provide the services of manufacturer's representative to prepare and start system.
- K. Provide full load test utilizing portable test bank, if required, for four hours minimum. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown and return to normal. Provide fuel required for testing.
- L. Record in 20 minute intervals during four hour test:
  - 1. Kilowatts.
  - 2. Amperes.
  - 3. Voltage.
  - 4. Coolant temperature.
  - 5. Room temperature.
  - 6. Frequency.
  - 7. Oil pressure.



**3.3. ADJUSTING**

**3.4. CLEANING**

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

**3.5. CLOSEOUT ACTIVITIES**

- A. Demonstrate operation to Owner's operating personnel:
  - 1. Describe loads connected to emergency and standby system and restrictions for future load additions.
  - 2. Simulate power outage by interrupting normal source, and demonstrate that system operates to provide emergency and standby power.
- B. Fill fuel tank to full level at Substantial Completion.

**3.6. MAINTENANCE**

- A. See Section 01 70 00 - Execution Requirements, for additional requirements relating to maintenance service.
- B. Provide service and maintenance of engine generator for one year from Date of Substantial Completion.

**END OF SECTION**

**LIGHTING****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Interior luminaires.
- B. Ballasts.
- C. Luminaire accessories.

**1.2. RELATED REQUIREMENTS**

- A. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 37 - Boxes.
- C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

**1.3. REFERENCE STANDARDS**

- A. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type); 2002.
- B. ANSI O5.1 - American National Standard for Wood Poles - Specifications and Dimensions; 2008.
- C. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).
- D. IESNA RP-8 - American National Standard Practice for Roadway Lighting; Illuminating Engineering Society of North America; 2000(R2005) (ANSI/IES RP8).
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- F. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.
- G. NECA/IESNA 501 - Recommended Practice for Installing Exterior Lighting Systems; 2006.
- H. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. NFPA 101 - Life Safety Code; 2015.
- K. UL 844 - Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.
- L. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- M. UL 1029 - High-Intensity-Discharge Lamp Ballasts; Current Edition, Including All Revisions.

**1.4. ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

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2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

**1.5. SUBMITTALS**

- A. See Section 01 60 00 - Submittal Procedures, for submittal procedures.
- B. Shop Drawings:
  1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
  1. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IESNA LM-63 standard format upon request.
  2. Ballasts: Include wiring diagrams and list of compatible lamp configurations.
  3. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
  4. Air Handling Luminaires: Include air handling performance data.
- D. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.
- E. Coefficients of Utilization by an approved testing laboratory.
- F. Lamp and ballast type for each fixture.
- G. Groups of fixtures with the same lamp and ballast type may reference a single set of submittal documents.
- H. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- I. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

**1.6. FIELD CONDITIONS**

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

**1.7. WARRANTY**

- A. See Section 01 70 00 - Execution and Closeout Requirements, for additional warranty requirements.
- B. Provide five year manufacturer warranty for all linear fluorescent ballasts.

**LIGHTING****PART 2 PRODUCTS****2.1. LUMINAIRES**

- A. All luminaires shall have LED technology.
- B. All luminaires in Warehouse, Shipping, or areas where there is an open structure shall be equipped with a integral occupancy sensor. Set to 20 minute intervals.
- C. Lights at warehouse roof level shall be hung by chain to Clear Height as shown in Division 01 - Project Summary. Provide minimum 53" clearance below roof deck and avoid interference with ESFR sprinkler heads. Where minimum clearance, or clear height cannot be met, install lights above sprinkler heads at roof deck.
- D. Coordinate warehouse lights with material handling systems and racking so that lights are centered in aisles, easily maintained, and not in conflict with ESFR sprinkler heads. Racked storage areas covers 350,000 SF of the building with a 10'-6" aisle. The 350,000 SF of racking includes 150,000 SF of 5 deep pushback rack and 200,000 SF of single selective and double deep rack.
- E. Provide the following average eight levels measured at 36" AFF:

Open Warehouse	30 FC with a Max/Min Ratio of 2.0 and under.
Staging Area	30 FC with a Max/Min Ratio of 2.0 and under.
Battery Charging	30 FC with a Max/Min Ratio of 2.0 and under.
Maintenance Areas	50 FC with a Max/Min Ratio of 2.0 and under.
Rack Aisles	25 FC with a Max/Min Ratio of 2.0 and under.

- F. Provide complete modular wiring system (Reloc) for all warehouse lighting. Branch circuiting can be either 277V or 480V.
- G. All warehouse lighting shall have integral occupancy/photosensors.
- H. Exterior Lighting:
  - 1. Provide outside lighting utilizing LED "Shoe-box" type fixtures on 40 FT poles. Locate light poles for truck court areas a minimum of 12' being the trailer curb.
  - 2. All pole lights in truck courts shall be mounted 36" diameter base, 48" above pavement/grade.
  - 3. All pole lights in parking lot shall be mounted on 24" diameter base, 30" above pavement.
  - 4. Minimum maintained foot-candle level shall be:

Auto Parking	2.5 FC average with 1.0 FC minimum.
Entrances	5.0 FC average.
Truck Courts	1.5 FC average with 0.5 FC minimum.

**LIGHTING**

Trailer Storage Lots	1.0 FC average with 0.5 FC minimum.
Truck Drives	0.5 FC average with 0.3 FC minimum.
Guard House Apron	4.0 FC minimum.

5. Provide conduit will pull wire from building out to all future auto and trailer parking areas as required to provide power for future lighting.
6. Provide extra 1" PVC conduit with pull wire from the inside of the building with 24" of the roof deck to each light pole in the trailer staging lot for Occupier yard management system. Daisy chain of the light poles is acceptable.
7. Parking lot, truck courts, and incoming road lighting shall be controlled by a central time clock and photocell combination through relay panels.
8. All exterior lighting shall be dark sky compliant.
- I. Provided products shall comply with NFPA 70.
- J. Provide products listed and labeled by Underwriters UL 1598.
- K. Recessed Luminaires:
  1. Ceiling Comparability: Comply with NEMA LE 4.
  2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
  3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- L. Fixtures - General:
  1. Finish shall be white baked enamel, unless otherwise specified with a minimum average reflectance of 85% on all exposed and light reflecting surfaces. Steel components shall be prepared for finishing with a 5-step zinc phosphating process.
  2. All fixtures mounted outdoors or in unheated spaces shall have 0 degree F ballasts.
- M. If fixtures specified herein are discounted at the time the work is executed, provide suitable substitute fixtures, without additional cost, as directed by the engineer.
- N. LED Luminaires: Listed and labeled as complying with UL 8750.
- O. Electrical Characteristics:
  1. 277V - Office/
  2. 480V - Warehouse/Site.

**2.2. ACCESSORIES**

- A. Provide accessory plaster frames for luminaires recessed in plaster ceilings.
- B. Provide accessories such as plaster frames, stem, canopies, cords, toggle bolts, etc., necessary to mount fixture in a proper and approved method.

**PART 3 EXECUTION****3.1. EXAMINATION**

- A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- B. Verify that suitable support frames are installed where required.
- C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

**LIGHTING**

- D. Verify that conditions are satisfactory for installation prior to starting work.

**3.2. INSTALLATION**

- A. Coordinate locations of outlet boxes provided under Section 26 05 37 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), and NECA 502 (industrial lighting). Coordinate with architectural reflected ceiling plans and mechanical plans.
- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. Square and rectangular fixtures shall be mounted with sides parallel to building lines and parallel with ceiling lines.
- F. Properly support and align fixtures and provide all necessary steel shapes for support of the fixtures. Recessed fluorescent fixtures shall be supported at opposite corners by steel wire connected to building structure per IBC requirements. Coordinate complete fixture installation with the facility construction.
- G. Surface Mounted Fixtures: Where fixtures are indicated for installation on low density ceiling material, mount on ceiling spacers as recommended by manufacturer unless UL approved for mounting directly to ceiling material.
- H. Install accessories furnished with each luminaire.
- I. Identify luminaires connected to emergency power system in accordance with Section 26 05 53.
- J. Install lamps in each luminaire.
- K. Verify all ceiling systems and coordinate fixture type and accessories prior to ordering fixtures.
- L. Install fixtures as recommended by the manufacturer or as necessary to provide exact horizontal alignment, preventing horizontal or vertical deflection, or angular jointing of fixtures installed in continuous rows.
- M. All lighting fixtures shall be furnished complete with lamps and all accessories necessary to provide a complete operable fixture.

**3.3. FIELD QUALITY CONTROL**

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.

**3.4. ADJUSTING**

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

**3.5. CLOSEOUT ACTIVITIES**

- A. See Section 01 70 00 - Execution and Closeout Requirements, for closeout submittals.

**LIGHTING**

- B. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.
- C. Just prior to Substantial Completion, replace all lamps that have failed.

**3.6. PROTECTION**

- A. Protect installed luminaires from subsequent construction operations.

**END OF SECTION**

**PATHWAYS FOR LOW VOLTAGE SYSTEMS CABLING****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Low voltage cabling systems pathways.
- B. Telecommunications & cable TV service entrance to building(s).
- C. Communications pathways.
- D. Pathways inside building(s).
- E. Pathways connecting building(s).
- F. Enclosures, backboards, and outlet boxes.
- G. Grounding and bonding the low voltage cabling pathway system.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 8400 - Firestopping.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0534 - Conduit.
- D. Section 26 0553 - Identification for Electrical Systems.
- E. Section 33 7119 - Electrical Underground Ducts and Manholes.

**1.3. PRICE AND PAYMENT PROCEDURES**

- A. See Section 01 2300 - Alternatives, for product alternatives affecting this section.

**1.4. REFERENCE STANDARDS**

- A. CEA-310 - Cabinets, Racks, Panels, and Associated Equipment; Consumer Electronics Association; Revision E, 2005.
- B. TIA-568-C.1 - Commercial Building Telecommunications Cabling Standard; Telecommunications Industry Association; Rev C, 2009 (with Addenda; 2012).
- C. TIA-568-C.2 - Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components; Telecommunications Industry Association; Rev C, 2009.
- D. TIA/EIA-568-B.3 - Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling Components Standard, and Addendum 1 - Additional Transmission Performance Specifications for 50/125 um Optical Fiber Cables; Rev B, 2000; Addendum 1.
- E. TIA-606-B - Administration Standard for the Telecommunications Infrastructure; Telecommunications Industry Association; Rev B, 2012.
- F. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

**1.5. DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Keep stored products clean and dry.



**1.6. WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a 1 year period after Date of Substantial Completion.

**PART 2 PRODUCTS**

**2.1. SYSTEM DESIGN**

- A. Provide a complete permanent system of cabling pathways for low-voltage system cabling including but not limited to: Voice and data communications, fire alarm, intercom/paging, clock, intrusion detection, access control, video surveillance, audio/visual, lighting controls and HVAC controls, including conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlet boxes.
- B. Drawings may indicate specific raceway requirements for some locations. The contractor is responsible for including the specific raceway requirements indicated in addition to those required of this and related specification sections.
- C. Provide conduit as indicated by related system device and/or equipment specification section to facilitate cable installation and as follows:
  - 1. Where cable is not allowed by applicable code to be routed in accessible ceiling spaces or in free-air.
  - 2. Where cable is allowed by applicable code to be routed in accessible ceiling spaces or in free-air.
    - a. From the Intermediate Distribution Frame, (IDF)/Telecommunications Closet (TC), Main Distribution Frame (MDF), or Equipment Room (ER) into accessible ceiling space.
    - b. From low voltage device outlet to an accessible ceiling space.
      - 1. For Voice and Data outlets:
        - a. Provide minimum one inch conduit for Cat 5E cable, 1-1/4 inch conduit for Cat 6 cable, from outlet box to accessible ceiling. See drawings for additional requirements.
      - 2. For Audio/Visual outlets:
        - a. See drawings.
      - 3. For Access Control, Intrusion Detection & Video Surveillance outlets:
        - a. Provide minimum one 3/4 inch conduit from outlet box to accessible ceiling. See drawings for additional requirements.
      - 4. For Fire Alarm outlets:
        - a. Provide minimum one 3/4 inch conduit from outlet box to accessible ceiling. See drawings for additional requirements.
      - 5. All other low-voltage device outlets:
        - a. As indicated on the drawings.
  - 3. Where routing cable across inaccessible ceiling spaces longer than 10 feet:
    - a. As indicated on drawings.

**PATHWAYS FOR LOW VOLTAGE SYSTEMS CABLING****2.2. PATHWAYS**

- A. Conduit: As specified in Section 26 0534.
- B. Surface Raceway: As specified in Section 26 05 35.
- C. Boxes: As specified in Section 26 05 37.
- D. Cable Trays: As specified in Section 26 0536.
- E. Overhead Service Entrance: Weatherhead or service entrance fitting located on outside of building with galvanized rigid steel or intermediate metallic conduit running to entrance facility.
- F. Underground Service Entrance: Rigid polyvinyl chloride (PVC) conduit, Schedule 40.

**2.3. IDENTIFICATION PRODUCTS**

- A. Comply with TIA-606.
- B. Comply with Section 26 0553.

**2.4. ENCLOSURES/BACKBOARDS**

- A. Backboards: Interior grade ACX or better plywood without voids, 3/4 inch thick; UL-labeled fire-retardant.
  - 1. Panel Size: 48 inches wide by 96 inches high. Provide minimum of one panel or quantity as necessary to accomplish coverage shown on drawings.
  - 2. Do not paint over UL label.
  - 3. Provide ground bus bar and #6 AWG CU ground conductor to service ground, as specified in Section 26 0526.

**2.5. DEVICE OUTLET BOXES**

- A. Unless otherwise specified in related device's system section; flush mount outlet box depth shall be as required to accommodate cable manufacturer's recommended minimum conductor bend radius.
  - 1. Size, Unless Otherwise Indicated: 4 inches square by 2-1/8 inches deep.
  - 2. Wall-Mounted Telephones: 4 inches high by 2 inches wide by 2-1/8 inches deep.

**PART 3 EXECUTION****3.1. INSTALLATION - GENERAL**

- A. Firestopping: Seal openings around pathway penetrations through fire-related walls, partitions, floors, and ceilings in accordance with Section 07 84 00.

**3.2. INSTALLATION OF PATHWAYS**

- A. Underground Service Entrance: Install conduit at least 24 inches below finish grade.
- B. Install with minimum clearances per Section 26 0534.

**PATHWAYS FOR LOW VOLTAGE SYSTEMS CABLING**

- C. In addition to as specified in Section 26 05 34, provide pull string in all conduits where there is available conduit fill capacity for future cable installation.

**3.3. INSTALLATION OF DEVICE OUTLET BOXES**

- A. Install per Section 26 05 37.
- B. Mounting heights: Unless otherwise indicated, as follows:
  - 1. Voice and Data Outlets: 18 inches above finished floor.
  - 2. Voice Outlets for Forward and Side-Reach Wall-Mounted Telephones: 45 inches above finished floor to top of telephone.
- C. Orient outlet boxes for vertical installation of devices unless otherwise indicated.

**END OF SECTION**

**STRUCTURED CABLING FOR VOICE AND DATA****PART 1 GENERAL****1.1. SECTION INCLUDES**

- A. Cabling and pathways inside building(s).
- B. Distribution frames, cross-connection equipment, enclosures, and outlets.
- C. Grounding and bonding the telecommunications distribution system.

**1.2. RELATED REQUIREMENTS**

- A. Section 07 8400 - Firestopping.
- B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
- C. Section 26 0534 - Conduit.
- D. Section 26 0536 - Cable Trays for Electrical Systems.
- E. Section 26 0537 - Boxes.
- F. Section 27 05 28 - Pathways for Low-Voltage Systems Cabling.

**1.3. SCOPE**

- A. This section describes the products and execution requirements relating to furnishing and installation of telecommunications cabling and termination components and related sub-systems as part of a structured cabling system. Vertical (backbone) and horizontal (station) cabling comprised of both copper and fiber optic cabling are covered under this document.
- B. The horizontal (station) cabling system is based on the installation of Category 6, 4-pair Unshielded Twisted Pair (UTP) for both data and voice copper cables. The cables to be installed from the Telecommunications Outlet to the Intermediate Distribution Frame (IDF)/Telecommunications Closet (TC), Main Distribution Frame (MDF), or Equipment Room (ER) serving that area and terminated as specified in this document. This may be supplemented with cabling in selected areas.
- C. Station cables to be installed in conduit, and/or free-air. Telecommunications Outlets to be mounted flush.
- D. Backbone copper and fiber optic cables to be installed in conduit in building riser pathways and/or free-air as determined by the Project Coordinator or identified on the drawings. Backbone intra-building fiber optic cabling to be installed via inner duct conduit. Refer to the sub-section below which details inner duct requirements. Provide plenum rated cable when routing in plenum spaces.
- E. Provide labor and materials necessary to construct the system as described herein and on the drawings. This includes, but is not limited to, furnishing and installing cable, cable supports, inner duct, racking and termination components, termination, testing, labeling and documentation. Installed system shall be fully functional and ready for use.

**1.4. REFERENCE STANDARDS**

- A. BICSI TDM Manual - Telecommunications Distribution Methods Manual; Building Industry Consulting Service International, Inc.; 2009.

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- B. EIA-310 - Cabinets, Racks, Panels, and Associated Equipment; Electronic Industries Association; Revision D, 1992.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; Rev A, 1988(R 2002).
- E. TIA-492AAAB-A - Detail Specification for 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009.
- F. TIA-492CAAA - Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers; 1998 (R 2002).
- G. TIA-526-7 - OFSTP-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant; 2002.
- H. TIA-526-14 - OFSTP-14 - Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; Rev A, 1998(R2003).
- I. TIA/EIA-568-B.1 - Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements; Rev B, 2001; Addenda 1-7.
- J. TIA/EIA-568-B.2 - Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components; Rev B, 2001; Addenda 1-11.
- K. TIA/EIA-568-B.3 - Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling Components Standard, and Addendum 1 - Additional Transmission Performance Specifications for 50/125 um Optical Fiber Cables; Rev B, 2000; Addendum 1.
- L. TIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces; 2009.
- M. TIA/EIA-606 - Administration Standard for the Telecommunications Infrastructure; Rev A, 2002.
- N. ANSI/J-STD-607 - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications; Rev A, 2002.
- O. UL 444 - Communications Cables; 2002.
- P. UL 497 - Standard for Protectors for Paired-Conductor Communications Circuits; 2001.
- Q. UL 514C - Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; 1996.
- R. UL 1581 - Reference Standard for Electrical Wires, Cables, and Flexible Cords; 2001.
- S. UL 1863 - Standard for Communications-Circuit Accessories; 2004.

**1.5. SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Storage and handling requirements and recommendations.
  - 2. Installation methods.
- C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding.
- D. Manufacturer Qualifications.

**STRUCTURED CABLING FOR VOICE AND DATA**

- E. Installer Qualifications.
- F. Test Plan: Complete and detailed plan, with list of test equipment and procedures for inspection and testing; submit at least 60 days prior to intended test date.
- G. Field Test Reports: Provide one copy to Owner and one copy to engineer of record two weeks prior to final commissioning/observations.
- H. Project Record Documents: Provide two sets, one for Owner and one for engineer of record of 1/8 inch = 1' 0" scale drawings.
  - 1. Record actual locations of outlet boxes and distribution frames.
  - 2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
  - 3. Identify distribution frames and equipment rooms by room number on contract drawings.
  - 4. Identify all telecommunications locations per labeling in 3.03, F.
- I. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents and shop drawings.

**1.6. QUALITY ASSURANCE**

- A. Manufacturer Qualifications: At least 3 years experience manufacturing products of the type specified.
- B. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:
  - 1. Supervisors and installers factory certified by manufacturers of products to be installed.

**1.7. DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees F, the cable to be moved to a heated (50 degrees F minimum) location.
- B. Keep stored products clean and dry. If necessary, cable to be stored off site at the Contractor's expense.

**1.8. WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. The Contractor shall provide a system warranty covering the installed cabling system against defects in workmanship, components, and performance, and follow-on support after project completion.
- C. The Contractor shall warrant the cabling system against defects in workmanship for a period of one year from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate

**STRUCTURED CABLING FOR VOICE AND DATA**

- performance within the original installation specifications after repairs are accomplished. This warranty shall be provided at no additional cost to the Owner.
- D. The Contractor shall facilitate a minimum 20-year system performance warranty between the manufacturer and the Owner. An extended component warranty shall be provided which warrants functionality of all components used in the system for a minimum of 20 years from the date of acceptance. The performance warranty shall warrant the installed 250 MHz horizontal copper, and both the horizontal and the backbone optical fiber portions of the cabling system. Copper links shall be warranted against the link performance minimum expected results defined in ANSI/TIA/EIA-568-B.2-1 (latest draft). Fiber optic links shall be warranted against the link and segment performance minimum expected results defined in ANSI/TIA/EIA-568-B.1.
- E. The Contractor shall furnish an hourly rate with the proposal submittal which shall be valid for a period of one year from the date of acceptance. This rate will be used when cabling support is required to affect moves, adds, and changes to the system (MACs). MACs shall not void the Contractor's nor manufacturer's warranty.

**PART 2 PRODUCTS****2.1. MANUFACTURERS**

- A. These specifications use a single manufacturer's name, model, or catalog number herein for the purpose of establishing a product set. An equivalent for the specified product set may be used upon approval by the architect or engineer of record.
- B. Approved manufacturers:
1. Panduit/General Cable: [www.panduit.com/www.generalcable.com](http://www.panduit.com/www.generalcable.com).
  2. Commscope Systemax: [www.commscope.com/systemax](http://www.commscope.com/systemax).
  3. Hubbell/Draka Comteq: [www.hubbell-premise.com/www.drakacomteq.us](http://www.hubbell-premise.com/www.drakacomteq.us).

**2.2. SYSTEM DESIGN**

- A. Provide a complete permanent system of cable and pathways for voice and data communications, including conduits and wireways, pull wires, support structures, enclosures and cabinets, rough-in boxes, and conduit sleeves.
1. Comply with TIA/EIA-568 and TIA/EIA-569, latest editions.
  2. Provide fixed cables and pathways that comply with NFPA 70 and ANSI/J-STD-607 and are UL listed.
  3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F at relative humidity of 0 to 95 percent, noncondensing.
  4. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.
  5. Capacity: As required to terminate all cables plus minimum 25 percent spare space.

**2.3. PATHWAYS**

- A. As specified in Section 27 05 28 - Pathways for Low Voltage Systems Cabling.

**STRUCTURED CABLING FOR VOICE AND DATA****2.4. BACKBONE CABLE****A. Fiber Optic Cable:**

1. Intra-building (premises cable):
  - a. 24-strand fiber, multimode 50/125 um, multimode 62.5/125 um, and single mode 8/125 um; covered with orange cable jacket.
    1. In locations other than in plenums, provide NFPA 70 type OFNR nonconductive-riser-rated or type OFNP nonconductive-plenum-rated cable.
    2. In plenums, provide NFPA 70 type OFNP nonconductive-plenum-rated cable.
2. Inter-building (indoor-outdoor cable):
  - a. 24-strand fiber, multimode 50/125 um, multimode 62.5/125 um, and single mode 8/125 um; covered with orange cable jacket.
    1. In locations other than in plenums, provide NFPA 70 type OFNR nonconductive-riser-rated or type OFNP nonconductive-plenum-rated cable.
    2. In plenums, provide NFPA 70 type OFNP nonconductive-plenum-rated cable.

**2.5. HORIZONTAL CABLE****A. Fiber Optic Cable:**

1. Two-fiber, multimode 50/125 um and 62.5/125 um; covered with orange single jacket.
  - a. In locations other than in plenums, provide NFPA 70 type OFN nonconductive general purpose, OFNR nonconductive-riser-rated, or type OFNP nonconductive-plenum-rated cable.
  - b. In plenums, provide NFPA 70 type OFNP nonconductive-plenum-rated cable.

**B. Copper Cable (voice and data):**

1. TIA/EIA-568 Category 6 solid conductor unshielded twisted pair (UTP), \_\_ AWG, individually twisted pairs; covered with blue jacket.
  - a. In locations other than in plenums, provide NFPA 70 type CMG general purpose, CMR riser-rated, or type CMP plenum-rated cable.
  - b. In plenums, provide NFPA 70 type CMP plenum-rated cable.

**2.6. TELECOMMUNICATION OUTLETS****A. Faceplates:**

1. 3 port angled faceplate constructed of ABS moulding compound. Each port shall be provided with an icon to indicate its function. Faceplate shall accommodate two labels and provide a clear polycarbonate cover for each. All unused port positions shall have a blank insert installed. Faceplate ports shall be populated left to right, top to bottom.



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2. Color: As selected by Architect.
- B. Modular jacks:
  1. All modular jacks shall be wired to the T568A or T568B wiring pattern. Modular jacks shall be constructed with a housing of polyphenylene oxide, 94V-0 rated. Modular jacks shall be terminated using a 110-style pc board connector (made of 94V-0 rated polycarbonate), color-coded for both T568A and T568B wiring. The 110 connector shall terminate 22-24 AWG solid conductors with a maximum insulation diameter of .05 inch. The modular jack contacts shall be plated with a minimum of 50 micro inches of gold in the contact area over a 50 micro inch minimum nickel underplate. Modular jacks shall be UL Listed.
  2. Color: As selected by Owner.
- C. Standard Configurations:
  1. Unless otherwise noted, all locations shall be provided with 2 Category 6 UTP cables terminated on Category 6 modular RJ-45 jacks.
  2. Wireless Access Point:
    - a. 1 - Category 6 UTP cable terminated on Category 6 modular RJ-45 jacks.
  3. Dedicated Phone:
    - a. 1 - Category 6 UTP cable terminated on Category 6 modular RJ-45 jacks.

**2.7. CROSS-CONNECTIONS AND ADAPTORS**

- A. Fiber Optic Terminal Enclosures:
  1. Backbone Cable:
    - a. Each fiber optic cable shall be terminated in the building MDF or IDF in appropriately sized rack mount patch enclosures (RMPE), providing protection for the terminated fibers. Contractor shall provide an appropriate number of RMPEs to accommodate project's installed fiber. The MDF enclosure shall accommodate project's installed fiber, plus an allowance for future growth equal to 50 percent of the installed capacity.
- B. Fiber Optic Adaptors:
  1. All fiber optic cable, whether single mode or multi-mode, shall be terminated using ST style fiber optic connectors.
  2. For multi-mode applications, ST connectors shall be 50/125  $\mu\text{m}$  or 62.5/125  $\mu\text{m}$  (to match cable) multi-mode connectors, capable of terminating either 250  $\mu\text{m}$  coated or 900  $\mu\text{m}$  buffered fibers. The connectors shall be field-installable, requiring no epoxy or polishing.
  3. For single mode applications, fiber shall be terminated using a fan-out kit or pigtail.
- C. Patch Panels for Fiber Optic Cabling: Sized to fit EIA standard 19 inch wide equipment racks; 0.09 inch thick aluminum.
  1. Adaptors: Maximum of 24 duplex adaptors per standard panel width.
  2. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA/EIA-606-A using encoded identifiers.
  3. Provide incoming cable strain relief and routing guides on back of panel.
  4. Provide rear cable management tray at least 8 inches deep with removable cover.

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5. Provide dust covers for unused adaptors.
- D. Copper Cross-Connection:
1. Voice Connection Blocks:
    - a. Manufacturer: CIRCA.
    - b. Voice backbone cables shall be terminated using wall-mounted 110Connect XC wiring blocks located in each IDF. Wiring blocks shall employ field terminated 110Connect XC kits, which include wiring blocks with mounting legs, connecting blocks, and designation strips. Backbone wiring blocks shall employ 5-pair connecting blocks, and wiring blocks shall be marked black every fifth pair. Connecting block terminals shall be constructed of phosphor bronze, plated with a minimum of 150 microinches of tin-lead over a 50 microinch minimum nickel underplate. Mushroom style wire management spools shall be provided to manage voice circuit cross connections.
    - c. All voice backbone cables routed from building exterior shall be terminated on wall-mounted overvoltage protection blocks immediately upon entering the building to protect telecommunications equipment from destructive transients. Protector blocks shall utilize 110-style connectors on both the input and output side. Protectors shall be solid state type.
  2. Patch Panels for Data Cabling: Sized to fit EIA standard 19 inch wide equipment racks; 0.09 inch thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
    - a. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
    - b. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
    - c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA/EIA-606-A using encoded identifiers.
- E. Patch Cord Assemblies:
1. Patch cords used at the telecommunication rack and at the workstation shall be Category 6. Patch cords shall be factory-assembled by the manufacturer of the cabling system.
  2. End user workstations will require a Category 6 patch cord. Provide a sufficient number of 10-foot gray workstation patch cords (AMP Part No. 219885-1--0) to equip two thirds of the terminated Cat 6 wires, e.g., 90 terminated wires will require 60 patch cords.
  3. 5-foot and 7-foot patch cords shall be provided to cross-connect between the data patch panels and network equipment in the IDF. Provide IDF patch cords equal to the number of workstation patch cords calculated in the previous paragraph. The total quantity of IDF patch cords shall be equally divided between the two assembly lengths. Shielded patch cords shall be provided where required.
    - a. Cat 6 Patch Cable, 5 feet, Gray
    - b. Cat 6 Patch Cable, 7 feet, Gray

**STRUCTURED CABLING FOR VOICE AND DATA****2.8. EQUIPMENT RACKS AND ENCLOSURES****A. Floor Mount (Open):**

1. Telecommunications Termination Rack: 7'H x 19"W; High strength lightweight aluminum construction E/W universal 5/8" - 5/8" - 1/2" alternating hole pattern. EIA channel: 6" x 1.25" x 1/4" thick flange, Base Angle: 3.5" x 6" x 3/8", Top Angle: 1.5" x 1.5" x 1/4", Top Bar: 1.5" x 1/4". Includes assembly and floor mounting hardware.
2. Manufacturer: Chatsworth Products, Inc., or approved equivalent.

**B. Floor Mount (Enclosed):**

1. Rail System: 84"H x 23"W x 24"D. High strength, lightweight aluminum, four post construction. Universal 5/8" - 5/8" - 1/2" alternating hole pattern. Locking front and rear doors. Front door shall have plexiglass face. Four vertical mounting rails, one vertical cable manager, set of four leveling feet, multi-bay attachment hardware kit. Include assembly and floor mounting hardware. Painted finish: black.
2. Provide two keys useable for all cabinets provided.
3. Manufacturer: Chatsworth Products, Inc.; Model M204070 (84"H x 23"W x 24"D): [www.chatsworth.com](http://www.chatsworth.com).

**C. Wall Mount (Enclosed):**

1. 36"H x 24"W x 24"D. High strength, lightweight aluminum construction. Universal 5/8" - 5/8" - 1/2" alternating hole pattern. Swing out wall-mount enclosure system, 200 lb. load rating, locking front and rear door as part of a three-section construction. Enclosure to include knock-outs for conduit/cable entry. Front/main access door shall have plexiglass face. Painted finish: black.
2. Provide two keys useable for all cabinets provided.
3. Manufacturer: Chatsworth Products, Inc.; Model 12419-736 (36"H x 24"W x 24"D): [www.chatsworth.com](http://www.chatsworth.com).

**D. Wire Management:**

1. Provide wire management in the following equipment rack configurations:
  - a. Floor mount (open):
    1. Vertical Wire Management: Chatsworth Products, Inc. black Combination Cabling Section (CCS). For single rack installations, mount a 6"W x 7'H x 12.24"D CCS (CPI part #30162-703) on each side of the rack. Where multiple racks abut, mount a 10"W x 7'H x 12.24"D CCS (CPI part #30163-703) between the racks and 6"W x 7'H x 12.24"D CCS (CPI part #30162-703) on each end of the ganged rack assembly.
    2. Horizontal Wiring Management: Chatsworth Products, Inc. black Universal Horizontal Cable Manager. Provide 19"W x 2U x 5.14"D cable managers (CPI Part #30130-719).
  - b. Wall mount (open):

**STRUCTURED CABLING FOR VOICE AND DATA**

1. Horizontal Wiring Management: Chatsworth Products, Inc. black Universal Horizontal Cable Manager. Provide 19"W x 2U x 5.14"D cable managers (CPI Part #30130-719).
- c. Floor mount (enclosed):
  1. Horizontal Wiring Management: Chatsworth Products, Inc. black Universal Horizontal Cable Manager. Provide 19"W x 2U x 5.14"D cable managers (CPI Part #30130-719).
- E. Ladder Racks:
  1. Manufacturer:
    - a. Chatsworth Products, Inc.; Model 10250-718 (18" wide rack):  
www.chatsworth.com.
  2. Tubular steel bar type cable racks with 0.065" thick side rails. 1.5" high x 0.375" wide stringers. 1.5" wide x 0.375" high rungs set 12" on center. Widths as noted.
  3. Complete with all necessary supports, hangars, connectors, nuts, bolts, etc., necessary for a complete installation.
  4. Ladder racks shall be supported a minimum of every 5 feet on center and at the end of every ladder rack run, utilizing trapeze type supports (as recommended by the manufacturer), attached directly to the structure above. Provide wall angle support kits where ladder rack terminates at wall.
  5. Provide end-closing kits on all ladder rack ends.
  6. Ladder racks shall be installed at 7'0" AFF to underside of ladder, unless otherwise noted.
  7. Coordinate placement of ladder racks and supports with duct work, conduits, piping, lighting fixtures, etc.

**PART 3 EXECUTION****3.1. INSTALLATION - GENERAL**

- A. Comply with latest editions and addenda of TIA/EIA-568, TIA/EIA-569, ANSI/J-STD-607, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

**3.2. INSTALLATION OF EQUIPMENT AND CABLING**

- A. Cabling - General Requirements:
  1. Do not install cable into conduits until conduit installation is complete.
  2. Do not over-cinch or crush cables.
  3. Do not exceed manufacturer's recommended cable pull tension and minimum bend radii.
  4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.
  5. Cable raceways shall not be filled greater than the NEC maximum fill for the particular raceway type.

**STRUCTURED CABLING FOR VOICE AND DATA**

6. Cables shall be installed in continuous lengths from origin to destination (no splices) unless specifically addressed in this document where cable splices are not allowed.
7. Cable shall be supported in conduit or cable tray where applicable. If a J-hook or trapeze system is used to support cable bundles, all horizontal cables shall be supported at a maximum of four-foot intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.
8. Cable shall be installed above fire-sprinkler and systems and shall not be attached to the system or any ancillary equipment or hardware. The cabling system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
9. Cables shall not be attached to ceiling grid or lighting support wires. Where light support for drop cable legs is required, the contractor shall install clips to support the cabling.
10. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
11. All backbone cables shall be installed in the following manner:
  - a. Backbone cables shall be installed separately from horizontal distribution cables.
  - b. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits or in separate innerducts within conduits.
  - c. Where cables are installed in an air return plenum, the cable shall be installed in conduit, or plenum cable shall be installed in a plenum innerduct to provide protection to the cable
  - d. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.

**B. Fiber Optic Cabling:**

1. Prepare for pulling by cutting outer jacket for 10 inches from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.
2. Support vertical cable at intervals as recommended by manufacturer.
3. Cable shall be installed in minimum 1 inch corrugated style innerduct enclosing the fiber optic cable in its entirety from termination to termination.
4. All strands are to be connected and tested. No strands are to be left 'dark'. Manufacturer's specifications for bend radii are to be strictly observed. Any instance where the bend radius of the optical cable must exceed that which is manufacturer specified or recommended shall immediately be brought to the attention of the Architect.
5. All fiber optic cable (and encasing innerduct) is not to be bound, wrapped, or otherwise secured to the copper twisted pair cable at any point, except as where the copper cable and innerduct may be commonly attached to a wall, and hence commonly supported by a wire hanger, or other approved mechanism.

**STRUCTURED CABLING FOR VOICE AND DATA**

6. Fiber slack shall be neatly coiled within the fiber termination panel. No slack loops shall be allowed external to the fiber panel(s).
  7. Each cable shall be individually attached to the respective termination panel by mechanical means. The cables strength member(s) shall be securely attached the cable strain relief bracket in the panel.
  8. Each fiber cable shall be stripped upon entering the termination panel and the individual fibers routed in the termination panel.
  9. Each cable shall be clearly labeled at the entrance to the termination panel. Cables labeled within the bundle shall not be acceptable.
  10. Dust caps shall be installed on the connectors and couplings at all times unless physically connected.
  11. Fiber optic hardware and terminations shall be performed by a technician who has either successfully completed a manufacturer's training course for terminating and maintaining fiber optic cable, or has successfully completed such a training program offered by an authorized distributor of optical cable and termination products.
  12. A 20-foot slack loop of fiber optic cable shall be left at the MDF and IDF prior to the cable entering any termination hardware.
  13. Splicing: All fiber routed between MDF and IDF is to be one continuous length, without exception. No splices are to be performed.
- C. Copper Cabling:
1. All outlets shall be installed in the following manner: Cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. No more than 12 inches of slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack may be neatly coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.
  2. Enough slack shall be stored in ceiling space for outlet to be relocated to furthest location in the room from the feeding IDF.
  3. In addition, each cable type shall be terminated as indicated below:
    - a. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-A document, manufacturer's recommendations, and/or best industry practices.
    - b. Pair untwist at the termination shall not exceed 0.25 inch from Category 6 connecting hardware.
    - c. The cable jacket shall be maintained as close as possible to the termination point.
  4. Horizontal distribution cables shall be bundled in groups of not greater than 40 cables. Cable bundle quantities in excess of 40 cables may cause deformation of the bottom cables within the bundle.
  5. UTP cable shall be installed so that there are no bends less than four times the outside diameter (4 x cable O.D.) at any point in the run. FTP cable shall be



**STRUCTURED CABLING FOR VOICE AND DATA**

installed so that there are no bends less than 8 times the outside diameter (8 x cable O.D.) at any point in the run.

D. Equipment Racks and Enclosures:

1. Racks shall be placed in a manner that will allow a minimum of 3 feet of clearance from the front and rear mounting surfaces and on one side. If one mounting rail of the rack is placed against a wall, the mounting rail shall be no closer than 7 inches to the wall to allow room for vertical wire management hardware. Where more than one rack is to be installed, the racks shall be ganged with vertical wire management hardware to provide inter-bay management. Ganged rack frames will be placed in a manner that will allow a minimum of 3 feet of clearance from the front and rear mounting surfaces and on one side of the ganged assembly.
2. Racks shall be securely attached to the concrete floor using 3/8 inch hardware.
3. All racks shall be grounded to the telecommunications ground bus bar.
4. Rack mount screws (#12-24) not used for installing panels and other hardware shall be bagged and left with the rack upon completion of the installation.
5. All installed racks shall comply with regional seismic requirements and I.B.C.
6. Wall mount racks shall be mounted on plywood backboard per Section 27 1005.

E. Field-Installed Labels: Comply with TIA/EIA-606-A using encoded identifiers.

1. Contractor shall submit for approval by Owner a proposed labeling system based on the above standard.

### **3.3. FIELD QUALITY CONTROL**

A. Visual Inspection:

1. Inspect cable jackets for certification markings.
2. Inspect cable terminations for color coded labels of proper type.
3. Inspect outlet plates and patch panels for complete labels.
4. Inspect patch cords for complete labels.
5. Inspect cable termination to validate that cables were dressed and terminated in accordance with ANSI/TIA/EIA specifications for jacket removal and pair untwist, compliance with manufacturer's minimum bend radius, and that cable ends are dressed in a neat and orderly fashion.

B. Testing - Fiber Optic Cabling:

1. Backbone: Perform optical fiber end-to-end attenuation test using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures; perform verification acceptance tests and factory reel tests. Post-installation tests shall be per ANSI/TIA/EIA 568-B.3 Standard.
2. Multimode Backbone: Perform tests in accordance with TIA/EIA-526-14 Method B.
3. Single Mode Backbone: Perform tests in accordance with TIA-526-7 Method B.
4. Links: Perform optical fiber end-to-end attenuation tests and field reel tests.

C. Testing - Copper Cabling and Associated Equipment:

1. Testing will be completed per Industry Standard for cable type to be tested. TIA/EIA-568-B.2-1 (Category 6), ISO/IEC 11801:2002 2nd Edition (classes D, E and F).

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2. Test backbone cables after termination but before cross-connection.
  3. Test backbone cables for DC loop resistance, shorts, opens, intermittent faults, and polarity between connectors and between conductors and shield, if cable has overall shield.
  4. Test operation of shorting bars in connection blocks.
  5. Category 3 Backbone: Perform attenuation test.
  6. Category 3 Links: Test each pair for short circuit continuity, short to ground, crosses, reversed polarity, operational and ring-back, and dial tone.
  7. Category 6 Backbone: Perform near end cross talk (NEXT) and attenuation tests.
  8. Category 6 Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.
- D. Testing - Documentation:
1. The Contractor shall compile test results into forms that contain all applicable test data. All forms shall be neatly completed and legible when submitted. Hard copy optical traces shall be neatly and securely attached to the test results where indicated. Computer disks containing trace files will be submitted at the same time.
- E. Test Verification:
1. Upon receipt of the test documentation, The Owner reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. Owner testing will use the same method employed by the Contractor, and minor variations will be allowed to account for differences in test equipment. If significant discrepancies are found, the Contractor will be notified for resolution.
- F. Final Inspection:
1. Upon completion of the project, The Owner's Technical Representative will perform a final inspection of the installed cabling system with the Contractor's Project Foreman. The final inspection will be performed to validate that all horizontal and backbone cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the Owner.

**END OF SECTION**



**PART 1 GENERAL**

**1.1. SECTION INCLUDES**

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Transmitters for communication with supervising station.
- C. Maintenance of fire alarm system under contract for specified warranty period.

**1.2. RELATED SECTIONS**

- A. Section 08 33 23 - Overhead Coiling Doors: Coiling fire doors to be released by fire alarm system.
- B. Section 08 71 00 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.
- C. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.

**1.3. REFERENCES**

- A. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits; 2002 (R2008).
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. NFPA 72 - National Fire Alarm Code and Signaling Code; 2010.
- D. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; 2009.

**1.4. SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Proposal Documents: Submit the following with cost/time proposal:
  - 1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
  - 2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
  - 3. Certification by Contractor that the system design will comply with the contract documents.
  - 4. Proposed maintenance contract.
- C. Drawings must be prepared using AutoCAD Release 2005 (or later).
  - 1. Owner will provide floor plan drawings for Contractor's use; verify all dimensions on Owner-provided drawings.
- D. Evidence of designer qualifications.
- E. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
  - 1. Copy (if any) of list of data required by authority having jurisdiction.
  - 2. NFPA 72 "Record of Completion", filled out to the extent known at the time.

3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
  4. System zone boundaries and interfaces to fire safety systems.
  5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
  6. Circuit layouts; number, size, and type of raceways and conductors; spare capacity calculations; notification appliance circuit voltage drop calculations.
  7. List of all devices on each signaling line circuit, with spare capacity indicated.
  8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
  9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
  10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
  11. Certification by Contractor that the system design complies with the contract documents.
  12. Do not show existing components to be removed.
  13. Shop drawings will need to be stamped by a NICET Level III certified fire alarm technician.
- F. Evidence of installer qualifications.
- G. Evidence of instructor qualifications; training lesson plan outline.
- H. Evidence of maintenance contractor qualifications, if different from installer.
- I. Inspection and Test Reports:
1. Submit inspection and test plan prior to closeout demonstration.
  2. Submit documentation of satisfactory inspections and tests.
  3. Submit NFPA 72 "Inspection and Test Form," filled out.
- J. Operating and Maintenance Data: See Section 01 78 00 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Complete set of specified design documents, as approved by authority having jurisdiction.
  2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
  3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
  4. List of recommended spare parts, tools, and instruments for testing.
  5. Replacement parts list with current prices, and source of supply.
  6. Detailed troubleshooting guide and large scale input/output matrix.
  7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
  8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

**FIRE ALARM SYSTEM**

- K. Project Record Documents: See Section 01 78 00 for additional requirements; have one set available during closeout demonstration:
  - 1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
  - 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
  - 3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- L. Closeout Documents:
  - 1. Certification by manufacturer that the system has been installed in compliance with his installation requirements, is complete, and is in satisfactory operating condition.
  - 2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
  - 3. Certificate of Occupancy.
  - 4. Written warranty.
  - 5. Report on training results.
- M. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.
  - 3. In addition to the items in quantities indicated in PART 2, furnish the following:
    - a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
    - b. Two copies, on CD-ROM, of all software not resident in read-only-memory.
      - 1. Extra Fuses: Two for each installed fuse; store inside applicable control cabinet.

**1.5. QUALITY ASSURANCE**

- A. Copies of Design Criteria Documents: Maintain at the project site for the duration of the project, bound together, an original copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction; deliver to Owner upon completion.
- B. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.
- C. Installer Qualifications: Firm with minimum 5 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.

1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
4. Contract maintenance office located within 50 miles of project site.
5. Certified in Oregon as fire alarm installer.
6. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.
7. Each and all items of the Fire Alarm System shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the "UL" label. All control equipment shall be listed under UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable.
8. All control equipment must have transient protection devices to comply with UL864 requirements.
9. In addition to the UL UOJZ requirement mentioned above, the system controls shall be UL listed for Power Limited Applications per NEC 760. All circuits must be marked in accordance with NEC article 760 23.

**1.6. WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.
- C. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion and certified test.

**PART 2 PRODUCTS**

**2.1. MANUFACTURERS**

- A. Fire Alarm Control Units - Basis of Design:
  1. Honeywell Security & Fire Solutions; Fire Control Instruments, Inc: [www.firecontrolinstruments.com](http://www.firecontrolinstruments.com).
  2. Honeywell Security & Fire Solutions; Notifier: [www.notifier.com](http://www.notifier.com).
  3. SimplexGrinnell 4010 Series: [www.simplexgrinnell.com](http://www.simplexgrinnell.com).
  4. GE Security; EST Series: [www.gesecurity.com](http://www.gesecurity.com).
    - a. Fire Alarm Control Units - Other Acceptable Manufacturers: Provided their products meet or exceed the performance of the basis of design product, products of the following are acceptable:
      1. Firelite 98010.
      2. Provide alternate pricing for alternate manufacturer.

- b. Initiating Devices, and Notification Appliances:
  - 1. Honeywell Security & Fire Solutions/Fire Control Instruments, Inc: [www.firecontrolinstruments.com](http://www.firecontrolinstruments.com).
  - 2. Honeywell Security & Fire Solutions/Notifier: [www.notifier.com](http://www.notifier.com).
  - 3. SimplexGrinnell: [www.simplexgrinnell.com](http://www.simplexgrinnell.com). Part numbers indicated are Simplex; equals by other manufacturers are acceptable, unless otherwise noted.
  - 4. GE Security: [www.gesecurity.com](http://www.gesecurity.com).
  - 5. Same manufacturer as control units.
  - 6. Provide all initiating devices and notification appliances made by the same manufacturer.
- c. Substitutions: See Section 01 60 00 - Product Requirements.
  - 1. For other acceptable manufacturers of control units specified, submit product data showing equivalent features and compliance with contract documents prior to bid per Section 01 60 00.
  - 2. For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with contract documents.

## **2.2. FIRE ALARM SYSTEM**

- A. Fire Alarm System: Provide modifications and extensions to the existing automatic fire detection and alarm system:
  - 1. Provide all components necessary, regardless of whether shown in the contract documents or not, for a complete and operable system.
  - 2. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
    - a. The Americans With Disabilities Act (ADA).
    - b. The requirements of the State Fire Marshal.
    - c. The requirements of the local authority having jurisdiction.
    - d. Applicable local codes.
    - e. The contract documents (drawings and specifications).
    - f. NFPA 101.
    - g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
  - 3. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
  - 4. Provide all monitoring and interlocks between fire alarm system and fire pump.
  - 5. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
  - 6. Program notification zones and voice messages as directed by Owner.

7. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
8. Fire Command Center: Location in Fire Pump Room.
9. Master Control Unit (Panel): In Fire Pump Room
10. Provide remote annunciator at main entry.
11. Supervising Stations and Fire Department Connections:
  - a. Public Fire Department Notification: By remote supervising station.
  - b. Remote Supervising Station: UL-listed central station under contract to facility.
  - c. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.
12. Circuits:
  - a. Initiating Device Circuits (IDC): Class B, Style A.
  - b. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 4.
  - c. Signaling Line Circuits (SLC) Between Buildings: Class A, Style 6.
  - d. Notification Appliance Circuits (NAC) within single building: Class B, Style Y.
  - e. Notification Appliance Circuits (NAC) between buildings: Class A, Style Z.
13. Spare Capacity:
  - a. Initiating Device Circuits: Minimum 25 percent spare capacity.
  - b. Notification Appliance Circuits: Minimum 25 percent spare capacity.
  - c. Speaker Amplifiers: Minimum 25 percent spare capacity.
  - d. Master Control Unit: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.
14. Power Sources:
  - a. Primary: Dedicated branch circuits of the facility power distribution system.
  - b. Secondary: Storage batteries.
  - c. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
  - d. Each Computer System: Provide uninterruptible power supply (UPS).

### **2.3. EXISTING COMPONENTS**

- A. Existing Fire Alarm System: Remove existing system completely after new system is fully operational and tested.
- B. Clearly label components that are "Not In Service."
- C. Remove unused existing components and materials from site and dispose of properly.

### **2.4. FIRE SAFETY SYSTEMS INTERFACES**

- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
  1. Sprinkler water control valves.

**FIRE ALARM SYSTEM**

2. Dry-pipe sprinkler system pressure.
  3. Dry-pipe sprinkler valve room low temperature.
  4. Sprinkler water storage tank low level.
  5. Sprinkler water storage tank low temperature.
  6. Fire pump(s).
- B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
1. Sprinkler water flow.
  2. Total flooding suppression system activation.
  3. Pump room heat detector.
  4. Duct smoke detectors.
- C. HVAC:
1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.
- D. Doors:
1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor.
  2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from.
  3. Overhead Coiling Fire Doors: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor.

**2.5. COMPONENTS**

- A. General:
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
  2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.
- B. Fire Alarm Control Units, Initiating Devices, and Notification Appliances: Analog, addressable type; listed by Underwriters Laboratories as suitable for the purpose intended.
- C. Master Control Unit: As specified for Basis of Design above, or equivalent.
1. Construction shall be modular with solid state, microprocessor based electronics. An 80 character LCD display shall indicate alarms, supervisory service conditions, and any troubles. Panel shall have 250 addressable points with internal dialer.
  2. Expansion Power Supplies: Provide as required for notification appliance circuits. Power supply to provide 8 Amps of power, four signal circuits, and battery standby.
- D. Remote Annunciators: Shall be 80 character LCD display and include four programmable control switches, as well as alarm silence, acknowledgment, and system reset switches.
- E. Initiating Devices:
1. Manual Pull Stations: Shall be addressable, single action, and constructed of high impact, red lexan with raised white lettering and a smooth high gloss finish. Stations which utilize screwdrivers, allen wrenches, or other commonly available



tools shall not be accepted. Stations shall be keyed alike with the fire alarm control panel. When the station is operated, the handle shall lock in a protruding manner to facilitate quick visual identification of the activated station.

- a. Provide 1 extra.
  - b. Provide 50 extra break rods.
2. Smoke Detectors: Photo electric smoke detectors with 4098 Series base. Each smoke detector shall have its own unique address, analog, and with selectable sensitivity. Detectors shall be listed to UL standard 268 and shall be documented compatible with the control equipment to which it is connected. Detectors shall be listed for this purpose by Underwriters Laboratories Inc. The detectors shall obtain their operating power from the fire alarm panel supervised detection loop. The operating voltage shall be 24VDC (nominal). Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal to be generated at the control panel. Each detector shall have a flashing status indicating LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady and at full brilliance. The detector may be reset by actuating the control panel reset switch. Remote LED alarm indicators shall be installed where indicated.
  - a. Provide 5 extra.
3. Duct Smoke Detectors: Shall be addressable and of the solid state photoelectric type. The detectors shall operate on the light scattering photodiode principle. Detector design shall provide full solid state construction and compatibility with being separately monitored via a unique address via the twisted shielded pair data loop.
  - a. Provide 1 extra.
4. Heat Detectors: Automatic heat detectors shall be combination rate-of-rise and fixed-temperature type. Each heat detector shall have its own unique address.
  - a. Provide 1 extra.
5. Addressable Interface Devices: .
  - a. Provide 3 extra.
- F. Notification Appliances:
  1. Audible/visible units shall provide a common enclosure for fire alarm audible and visual alarm devices. Models shall be available which provide for horizontal or vertical mounting and with high humidity and strobe synchronization options. The audio/visual combination unit shall provide 4 Wire connection to ensure properly supervised in/out system connection and shall be UL listed for its intended purpose. Device candela shall be rated per current NFPA and ADA requirements.
    - a. Simplex 4906 Series or approved.
- G. Circuit Conductors: Copper; color code and label.
- H. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
  1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
  2. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a



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- building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
3. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.
- I. Locks and Keys: Deliver keys to Owner.
1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type.
- J. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
  2. Provide one for each control unit where operations are to be performed.
  3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
  4. Provide extra copy with operation and maintenance data submittal.
- K. Storage Cabinet for Spare Parts and Tools: Steel with baked enamel finish, size appropriate to quantity of parts and tools.
1. Padlock eye and hasp for lock furnished by Owner.
  2. Locate as directed by Owner.

**PART 3 EXECUTION****3.1. INSTALLATION**

- A. Install the system in accordance with the plans and specifications, all applicable codes, and the manufacturer's recommendations. All wiring shall be installed in strict compliance with all the provisions of NEC - Article 760 A and C, Power-Limited Fire
- B. Protective Signaling Circuits or if required may be reclassified as non-power limited and wired in accordance with NEC-Article 760 A and B. Upon completion, the contractor shall so certify in writing to the owner and general contractor. All junction boxes shall be sprayed red and labeled "Fire Alarm". Wiring color code shall be maintained throughout the installation.
- C. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- D. Obtain Owner's approval of locations of devices, before installation.
- E. Install instruction cards and labels.
- F. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate subcontractors.
- G. The contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.
- H. The manufacturer's authorized representative shall provide on site supervision of installation.

**3.2. INSPECTION AND TESTING FOR COMPLETION**

- A. Notify Owner 7 days prior to beginning completion inspections and tests.

- B. Owner will provide the services of an independent fire alarm engineer or technician to observe all tests.
- C. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- D. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- E. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- F. Provide all tools, software, and supplies required to accomplish inspection and testing.
- G. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- H. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.
- I. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
  - 1. Record all system operations and malfunctions.
  - 2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
  - 3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
  - 4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

### **3.3. OWNER PERSONNEL INSTRUCTION**

- A. Provide the following instruction to designated Owner personnel:
  - 1. Hands-On Instruction: On-site, using operational system.
  - 2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
  - 3. Factory Instruction: At control unit manufacturer's training facility, as required.
  - 4. Provide a total of 16 hours of initial/refresher training to designated Owner personnel covering issues for the topics below. Duration of individual training sessions as determined by Owner, not to exceed total number of required hours.
    - a. Administrative: Issues necessary for non-technical administrative staff.
    - b. Basic/Detailed Operation: Issues necessary for attendant personnel, security officers, and engineering staff.
    - c. Maintenance Technicians: Issues necessary for electrical technicians on programming, maintaining, repairing, and modifying.
  - 5. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.
  - 6. Provide means of evaluation of trainees suitable to type of training given; report results to Owner.

### **3.4. CLOSEOUT**

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.

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1. Be prepared to conduct any of the required tests.
2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
3. Have authorized technical representative of control unit manufacturer present during demonstration.
4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
5. Repeat demonstration until successful.
6. Occupancy of the project will not occur prior to Substantial Completion.
7. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
  - a. Specified diagnostic period without malfunction has been completed.
  - b. Approved operating and maintenance data has been delivered.
  - c. Spare parts, extra materials, and tools have been delivered.
  - d. All aspects of operation have been demonstrated to Owner.
  - e. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
  - f. Occupancy permit has been granted.
  - g. Specified pre-closeout instruction is complete.
8. Perform post-occupancy instruction within 3 months after Substantial Completion.

**3.5. MAINTENANCE**

- A. See Section 01 70 00 - Execution Requirements, for additional requirements relating to maintenance service.
- B. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.
- C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
  1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
  2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
  3. Record keeping required by NFPA 72 and authorities having jurisdiction.
  4. Provide trouble call-back service upon notification by Owner:
    - a. Provide on-site response within 2 hours of notification.
    - b. Include allowance for call-back service during normal working hours at no extra cost to Owner.
    - c. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

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5. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
6. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.
7. Comply with Owner's requirements for access to facility and security.

**END OF SECTION**

**EARTHWORK****SECTION 31 05 13 - EARTHWORK****PART 1 GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Removing surface debris, designated paving, curbs, topsoil, etc.
2. Removing designated trees, shrubs, and other plant life.
3. Removing abandoned utilities.
4. Excavation and rough grading, cutting, grading, filling, contouring and, compacting for building foundations, site structures, roads, parking areas, slabs-on-grade and landscaping.
5. Excavating trenches for utilities from 2 feet outside building to connection with public utility service. Compacting backfilling and compacting from top of utility bedding to subgrade elevations.
6. Removing identified and discovered rock during excavation.
7. Backfilling site structures perimeter to subgrade elevations, fill under slabs-on-grade, fill under paving, fill for over-excavation.

**B. Related Sections:**

1. Section **01 33 00** - Submittal Procedures
2. Section 32 91 19 – Landscape Grading, Topsoil, and Soil Preparation
3. Section 33 11 16 - Site Water Utility Distribution Piping
4. Section 31 25 13 - Erosion Controls
5. Section 33 31 00 – Sanitary Utility Sewerage Piping
6. Section 33 41 00 – Storm Utility Drainage Piping
7. Contract Documents - Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division I Specification Sections.
8. Document [1200C]: Oregon DEQ Construction Stormwater General Permit.
9. Document: Geotechnical report.

**1.2 REFERENCES****A. ASTM International:**

1. ASTM C117 - Standard Test Method for Materials Finer than 75- $\mu$ m (No. 200) Sieve in Mineral Aggregates by Washing
2. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
3. ASTM D1157 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft-lbf/ft<sup>3</sup>.
4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

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- B. National Fire Protection Association: NFPA 495 - Explosive Materials Code.
- C. OSSC refers to the current edition of the State of Oregon/ APWA, Standard Specifications for Construction.
- D. Regulatory Requirements: All materials and construction work within the public rights of way or for public facilities within easements shall be provided and constructed in accordance with the requirements and specifications of the Governing Authority having Jurisdiction.

**1.3 DEFINITIONS**

- A. Utility: Any buried pipe, duct, conduit, or cable.
- B. Rock: Solid mineral material of size that cannot be removed as defined in the geotechnical report.

**1.4 SUBMITTALS**

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Samples: Submit, in air-tight containers, 10 lb sample of each type of fill to testing laboratory.
- C. Materials Source: for materials used as imported fill material and pipe bedding and backfill. Submit name and location of imported fill materials source.
- D. For information, submit description of vibratory compactors proposed for use when requesting placement of backfill and fill materials greater than requirement established herein.
- E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
- F. Product Data: Submit data for herbicide. Indicate compliance with applicable codes for environmental protection. Submit data for geotextile fabric indicating fabric and construction.
- G. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.
- H. Shop Drawings: Rock Removal: Indicate proposed method of blasting, delay pattern, explosive types, type of blasting mat or cover, and intended rock removal method. Survey Report: Submit survey report on conditions of buildings near locations of rock removal.

**1.5 QUALITY ASSURANCE**

- A. Codes and Standards: Perform Work in accordance with applicable requirements of governing authorities having jurisdiction and the recommendations of the geotechnical report.

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- B. Conform to all applicable codes for environmental requirements, disposal of debris, use of herbicides, and installation of protection and erosion control devices.
- C. Soil Testing Service:
  - 1. The OWNER will engage a soil testing service, to include testing soil materials proposed for use in the work and for quality control testing during excavation and fill operations.
  - 2. Samples of materials shall be furnished to the testing service by the CONTRACTOR.
  - 3. Under this Contract, the CONTRACTOR shall smooth out areas for density tests and otherwise facilitate testing work as directed.
- D. Rock Removal: Seismic Survey Firm: Licensed company specializing in seismic surveys with a minimum of five years documented experience. Explosives Firm: Company specializing in explosives for disintegration of rock, with a minimum of five years documented experience.
- E. Maintain one copy of each document on site.
- F. Furnish each imported soil and aggregate material from single source throughout the Work.

**1.6 CLOSEOUT SUBMITTALS**

- A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

**1.7 QUALIFICATIONS**

- A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of work being performed.

**1.8 FIELD MEASUREMENTS**

- A. Verify field measurements prior to fabrication.

**1.9 COORDINATION**

- A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.
- B. ROCK REMOVAL: Schedule Work to avoid working hours of and disruption to occupied buildings nearby. Conduct blasting operations between hours as required by Jurisdiction having authority only.

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**1.10 PROJECT CONDITIONS**

- A. Site information: Subsurface conditions were investigated by GeoDesign. Samples, logs and other data may be inspected by contacting them.
1. The data on subsurface conditions are not intended as representations or warranties or accuracy or continuity of such conditions between soil borings. It is expressly understood the Owner will not be responsible for interpretations or conclusions drawn there from by the CONTRACTOR. The data is made available for the convenience of the CONTRACTOR
  2. Additional test borings and other exploratory operations may be made by the CONTRACTOR at no additional cost to the Owner.
- B. Disposal of Waste Material:
1. Disposal sites for earth waste materials are not available on Owner's property. Materials that are not suitable for use as topsoil or cannot be used in embankments or construction shall be disposed off-site.
  2. CONTRACTOR shall restrict temporary storage of waste materials and materials to be reused to the designated work areas.
  3. CONTRACTOR shall arrange and pay for removal and disposal of all waste materials encountered in the work.
- C. Existing Utilities:
1. Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protection during excavation operations.
  2. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with the Owner and public and private utility companies in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner.
  3. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.
  4. Demolish and completely remove from the site existing underground utilities which are not to remain in service and are located within an excavation area. Coordinate with local utility companies for shut-off services in lines that are active.
- D. Rock Removal:
1. Conduct survey and document conditions of buildings near locations of rock removal, prior to blasting, photograph existing conditions identifying existing irregularities. Advise owners of adjacent buildings or structures in writing, prior to executing seismographic survey. Explain planned blasting and seismic operations. Obtain seismic survey prior to rock excavation to determine maximum charges that can be used at different locations in area of excavation without damaging adjacent properties or other work.



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**PART 2 PRODUCTS****2.1 HERBICIDE**

- A. Type, approved by authority having jurisdiction.

**2.2 SUBSOIL MATERIALS**

- A. Subsoil Type:
1. Excavated and re-used material or imported clean structural borrow as approved by the project Geotechnical Engineer.
  2. Any on-site materials free of organic matter, non-plastic (dried), containing no particles larger than recommended, capable of compaction as specified, and approved by the Geotechnical Engineer and Governing Authorities having jurisdiction prior to use in the Work.
  3. Imported Fine-Grained Structural Fill Material: Material approved by the Geotechnical Engineer and Governing Authorities having jurisdiction for use as embankment material from an off-site source other than imported granular material. The source shall be approved by the Geotechnical Engineer and Governing Authorities having jurisdiction prior to use in the Work.

**2.3 TOPSOIL MATERIALS**

- A. Stripping:
1. Grass, sod, roots and other types of vegetation as well as concrete, wood and other deleterious materials to be removed.
- B. Topsoil:
1. Unclassified excavated and reused or imported material, free of roots, rocks larger than ½ inch, subsoil, debris, large weeds and foreign matter meeting the requirements of the Geotechnical Report or landscape specifications for topsoil characteristics.

**2.4 CRUSHED AGGREGATE MATERIALS**

- A. Pipe Bedding and Backfill Material: Crushed rock with a maximum particle size of ¾"-0". The aggregate shall be well-graded capable of compaction meeting OSSC as specified in trench zone. Material shall be approved by the Geotechnical Engineer and Governing Authorities having jurisdiction prior to use in the Work.
- B. Trench Stabilization Material: Trench stabilization material shall consist of quarry run rock, crushed rock, or crushed gravel and sand and shall meet the requirements set forth by ODOT SS 00330.14 and 00330.15, with a minimum particle size of 6 inches and less than 5 percent passing the U.S. Standard No. 4 Sieve. The material shall be free of organic matter and other deleterious material. Trench stabilization material shall be placed in lifts between 12 -18 inches and compacted to a firm condition. Material shall be approved by

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the Geotechnical Engineer and Governing Authorities having jurisdiction prior to use in the Work.

- C. Coarse Aggregate: Angular crushed aggregate, Pit run as approved by the Geotechnical Engineer, the Governing Authorities having jurisdiction or OSSC standards prior to use in the Work.
- D. Floor Slab Base Rock: Capillary break aggregate should be crushed rock with a maximum particle size of 1 ½" for under floor slabs. The aggregate shall be well-graded capable of compaction meeting OSSC as specified, with not more than 5% passing the #200 sieve. Material shall be approved by the Geotechnical Engineer and Governing Authorities having jurisdiction prior to use in the Work.
- E. Free Draining Fill: Free-draining material for blanket or wall drains for the subdrainage system shall be crushed rock with a maximum size of 2" with not more than 2% passing the #200 sieve (washed analysis) meeting OSSC 00430-11.

**2.5 ACCESSORIES**

- A. Geotextile Fabric: As recommended in the geotechnical report.

**2.6 SOURCE QUALITY CONTROL**

- A. Section 01 40 00 - Quality Requirements: Testing and Inspection Services, Testing and analysis of soil material.
- B. Testing and Analysis of Material: Perform in accordance with ASTM D1157, AASHTO T180, ASTM D4318 and/or ASTM C136 as recommended in the geotechnical report.
- C. When tests indicate materials do not meet specified requirements, change material and retest.
- D. Furnish materials of each type from same source throughout the Work.

**PART 3 EXECUTION****3.1 EXAMINATION**

- A. Verify site conditions and note subsurface irregularities affecting Work of this section.
- B. Verify existing plant life designated to remain is tagged or identified.
- C. Identify temporary waste area for placing removed materials until materials can be reused on site or hauled offsite and disposed of properly.

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- D. Verify locations of survey benchmarks, property corners and intended elevations for the Work and protect from damage.

**3.2 PREPARATION**

- A. “Call Before You Dig” - Call Utility Notification Center at (800) 424-5555 or 811 not less than two nor more than 10 business days before performing Work.
  - 1. Request underground utilities to be located and marked within and surrounding construction areas.
  - 2. Cost(s) for locating utilities will be the responsibility of the CONTRACTOR.
- B. Identify required lines, levels, contours, and datum.
- C. Notify utility company(ies) to remove and/or relocate utilities as required.
- D. Locate, identify, and protect utilities to remain, from damage. If utilities are to remain in place, provide adequate means of protection during Site Clearing operations.
  - 1. Should uncharted or incorrectly charted piping or other utilities be encountered during Work in this section, immediately consult utility owner for directions and notify Owner’s representative. Cooperate with the Owner’s representative and public and private utility companies in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner.
  - 2. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by Owner’s representative and then only after acceptable temporary utility services have been provided.
- E. Establish approved temporary traffic control and detours when trenching is performed in public rights-of-way. Relocate controls and reroute traffic as required during progress of Work.

**3.3 PROTECTION**

- A. Locate, identify, and protect utilities indicated to remain, protect from damage.
- B. Protect trees, other vegetation, and features remaining as a portion of the final landscaping, as indicated on the drawings and or as directed by the Owner’s representative.
- C. Protect benchmarks, survey control points, and existing structures from damage or displacement.
- D. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- E. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.
- F. Reshape and re-compact fills subjected to vehicular traffic during construction.

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- G. Barricade: Open excavations in compliance with code requirements. Protect structures, utilities, sidewalks, pavement, and other facilities immediately adjacent to excavations, from damages caused by settlement, lateral movement, undermining, washout and other hazards. Do not leave more than 15 feet of trench open at end of working day.
- H. Excavation Safety: The CONTRACTOR shall be solely responsible for making all excavations in a safe manner. Provide appropriate measures to retain excavation side slopes and prevent rock falls to ensure that persons working in or near the excavation are protected. CONTRACTOR shall follow all OHSA rules and regulations.
- I. Protect excavation cuts or open trenches to prevent danger to the public.
- J. Protect sidewalks, paving and curbs from equipment, vehicular traffic and general construction activities.
- K. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- L. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- M. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, compact to required density and provide other corrective work as specified, prior to further construction.
- N. Protection of Subgrade: Do not allow equipment to disturb subgrade, stripped areas, or other areas prepared for project. Prevent water from collecting on surface. Repair disturbed subgrade as specified below for unauthorized excavation.
- O. Excavation Safety: The CONTRACTOR shall be solely responsible for making all excavations in a safe manner. Provide appropriate measures to retain excavation side slopes and prevent rock falls to ensure that persons working in or near the excavation are protected.
- P. Notify Engineer of unexpected subsurface conditions and discontinue affected work in the area until notified to resume operations.

**3.4 CLEARING**

- A. Clear areas required for access to site and execution of Work to minimum depth are recommended and approved by the project Geotechnical Engineer.
- B. **CONTRACTOR shall stake construction / clearing limit for approval by Owner's representative prior to Work. Identify special considerations for protecting existing Trees and vegetation within the drainage channels. Protection measure must be in place prior to commencing Work and must be maintained throughout the construction period. No Work shall be performed beyond designated construction limit. CONTRACTOR is responsible for damage to significant resources and buffers as a result of careless Work, including all costs required to remedy the damage.**

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- C. Remove vegetation, pavement, curbs, other materials and miscellaneous debris, or obstructions interfering with installation of new construction unless otherwise indicated on drawings or by the Owner's representative as protected. Remove such items off-site unless indicated differently by the Owner's representative. Removal includes stumps and roots.
- D. Strip all organic matter under areas to receive pavement, sidewalks, building pads and other structural features. Remove off-site unless being used as topsoil or as directed by the Owner's representative.
- E. Clear undergrowth and deadwood, without disturbing subsoil.
- F. Strip grass and weeds from planting areas to be planted (seed and plants) to a depth approved by the Geotechnical Engineer and the landscape specifications. Leave remaining topsoil in place unless as directed by Owner's representative.
  - 1. Strip only areas that are accessible to equipment without causing damage to existing trees and vegetation to be preserved. Manual stripping by method of grubbing and hand removal, per these specifications, will be approved in sensitive areas. CONTRACTOR shall identify and review sensitive areas with Owner's representative prior to Work.
- G. Apply herbicide to remaining stumps to inhibit growth.

**3.5 CLEARING REMOVAL**

- A. Demolish and completely remove from the site existing underground utilities which are not to remain in service and are located within the Work area. Coordinate with local utility companies for shut-off services in lines that are active.
  - 1. Remove abandoned utilities as indicated on the drawings. Indicate removal termination point for underground utilities on Record Documents.
- B. Remove debris, rock, and extracted plant life from site.
- C. Remove demolished paving, curbs, sidewalks and other incidental materials for a complete project. Neatly saw cut edges at right angle to surface.
- D. Remove abandoned utilities. Indicated removal termination point for underground utilities on Record Documents.
- E. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site. CONTRACTOR shall restrict temporary storage of waste materials and materials to be reused to approved, designated areas.
- F. Do not burn or bury materials on site. Fill excavations and pits created by Work to adjacent grades. Leave site in clean condition.

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**3.6 TOPSOIL EXCAVATION**

- A. Excavate topsoil from areas to be further excavated, re-landscaped or regraded without mixing with foreign materials for reuse in finish grading.
- B. Stockpile material to be reused in area designated on site to depth not exceeding 8 feet and protect from erosion.
- C. Remove excess topsoil not intended for reuse, from site.

**3.7 EXCAVATION**

- A. Excavation consists of removal and disposal of all material encountered when establishing required grade elevations. All excavation is unclassified. The contours or spot elevations indicated on the drawings indicate finish grade unless otherwise indicated.
- B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of the OWNER'S REPRESENTATIVE. Unauthorized excavation, as well as remedial work directed by the OWNER'S REPRESENTATIVE, shall be at no change in Contract amount.
- C. Additional Excavation: When excavation has reached required subgrade or trench invert elevations, notify the Geotechnical Engineer who will observe conditions.
  - 1. Proof roll ground surface. Proof rolling will be observed by the Geotechnical Engineer. Remove soft areas detected by the proof rolling and replace with compacted structural fill material as directed.
  - 2. If unsuitable bearing materials are encountered at the required subgrade elevations, carry excavations deeper and replace the excavated material as directed by the Geotechnical Engineer.
- D. Stability of Excavations: The stability of excavation slopes will be the responsibility of the CONTRACTOR in conformance with the recommendations of the geotechnical investigation.
- E. Shoring and Bracing: Provide shoring and bracing to comply with local codes and authorities having jurisdiction. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of the time period excavations will be open. Carry down shoring and bracing as the excavation progresses.
- F. Underpin adjacent structures which may be damaged by excavation work.
- G. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding the project site and surrounding area.
  - 1. Do not allow water to accumulate in excavations. Remove water to prevent detrimental soil changes to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines and other dewatering system components necessary to convey water away from excavations.

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2. Convey water removed from excavations and rainwater to collection or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations or public utility lines as temporary drainage facilities.
- H. Excavation for Building Pads:
1. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10' and extend a sufficient distance from footings and foundations to permit placing and removal of concrete form work, installation of services, other construction and for inspection (5 feet minimum).
  2. In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is to be placed. Trim bottoms to required lines and grades to leave solid base to receive concrete.
- I. Excavation for Pavements: Cut surface under pavements to comply with cross-sections, elevations and grades as shown.
- J. Excavate subsoil to accommodate building foundations, slabs-on-grade, paving sections, site structures and construction operations.
- K. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity or greater as required by the Geotechnical Engineer.
- L. Slope banks with machine to angle of repose or less until shored. Do not interfere with 45 degree bearing splay of foundations.
- M. Grade top perimeter of excavation to prevent surface water from draining into excavation. Trim excavation. Remove loose matter. Remove lumped subsoil, boulders, and rock.
- N. Notify Architect/Engineer of unexpected subsurface conditions. Correct areas over excavated with structural fill as directed by the Geotechnical Engineer. Repair or replace items indicated to remain damaged by excavation.
- O. Excavate and process wet material to obtain optimum moisture content.
- P. When excavating through roots on trees to remain, perform Work in accordance with the Arborist's report.
- Q. Remove excess subsoil not intended for reuse, from site.
- R. Benching Slopes: Horizontally bench existing slopes as recommended by the Geotechnical Engineer to provide firm bearing.
- S. Stability: Replace damaged or displaced subsoil as specified for fill.
- T. Remove excavated materials not meeting requirements for subsoil materials or structural fill from site.



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- U. Dust: CONTRACTOR shall assume full responsibility for all alleviation or prevention of dust nuisance on or about the site in compliance with regulatory requirements.

**3.8 TRENCHING**

- A. Excavations for Trenches: Performed as part of work installed.
1. Dig trenches to the uniform width required for the particular item to be installed, sufficient minimum width as shown on the Drawings and to provide ample working room.
  2. Excavate trenches to the depth indicated or required. Carry the depth of trenches for piping to establish the indicated flow lines and invert elevations. Beyond the building perimeter, keep bottoms of trenches sufficiently below grade to avoid freeze-up and outside of the 1:1 slope beyond the bottom of the footings.
  3. When unstable pipe foundation is encountered, place a minimum of 12 inches of imported granular trench stabilization material under the pipe bedding material to stabilize the trench or as directed by the Geotechnical Engineer.
  4. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for the entire body of the pipe.
  5. Backfill trenches prior to tests and inspections. Use care in backfilling to avoid damage or displacement of pipe systems.
- B. Trench for pipes to lines and grades indicated on Drawings.
1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.
  2. Use laser-beam instrument with qualified operator to establish lines and grades.
- C. Excavate subsoil required for utilities to utility service point of connection.
- D. Perform excavation of existing utility service in accordance with utility's requirements.
- E. Do not advance open trench more than 100 feet ahead of installed pipe.
- F. Cut trenches to width indicated on Drawings or sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work.
- G. Excavate bottom of trenches maximum 2 feet wider than outside diameter of pipe.
- H. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe utilities.
- I. Do not interfere with 45 degree bearing splay of foundations.
- J. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section.



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- K. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Geotechnical Engineer until suitable material is encountered. Notify Geotechnical Engineer, and request instructions.
- L. Trim excavation. Hand trim for bell and spigot pipe joints and remove loose matter.
- M. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

**3.9 ROCK REMOVAL BY MECHANICAL METHOD**

- A. Excavate and remove rock by mechanical method.
  - 1. Drill holes and use expansive tools, wedges or mechanical means to fracture rock.
- B. Cut away rock at bottom of excavation to form level bearing.
- C. Remove shaled layers to provide sound and unshattered base for footings and foundations.
- D. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.
- E. Remove excavated materials from site or crush and reuse as fill if needed.

**3.10 ROCK REMOVAL BY EXPLOSIVE METHODS**

- A. When rock is uncovered requiring explosives method for rock disintegration, notify Engineer.
- B. Provide seismographic monitoring during progress of blasting operations.
- C. Prepare a drilling and blasting plan and submit to Jurisdiction having authority for review and approval.
- D. Disintegrate rock and remove from excavation.
- E. Remove rock at excavation bottom to form level bearing.
- F. Remove shaled layers to provide sound and unshattered base for footings and foundations.
- G. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.
- H. Remove excavated materials from site or crush and reuse as fill if needed.

**3.11 BACKFILL, FILLING AND GRADING**

- A. In all excavations, unless otherwise specified, use satisfactory excavated or imported material for backfill which has been sampled and tested by the Geotechnical Engineer. On-

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site fine-grained soils may be used in structural fills only during dry conditions when optimum moisture content can be maintained. Use optimum moisture conditioned imported fill material as structural fill during wet conditions, when onsite soils cannot be utilized.

- B. Compact subgrade to density requirements for subsequent backfill materials.
- C. Proof roll to identify soft spots. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill and compact to density equal to or greater than requirements for subsequent fill material.
- D. Scarify subgrade surface to depth as recommended by the Geotechnical Engineer.
- E. Proof roll to identify subsequent soft spots, fill and compact to density equal to or greater than requirements for subsequent fill material.
- F. Fill areas to contours and elevations with unfrozen materials.
- G. Place fill material in continuous layers and compact in accordance with the recommendations of the Geotechnical engineer.
- H. Backfill simultaneously on each side of unsupported foundation walls until supports are in place. Do not backfill against unsupported foundation walls.
- I. Backfill excavations as promptly as work permits, but not until completion of the following:
  - 1. Acceptance by OWNER'S REPRESENTATIVE of construction below finish grade including, where applicable, waterproofing, damp proofing, drainage pipe and perimeter insulation.
  - 2. Inspection, testing, approval and recording of locations of underground utilities.
  - 3. Removal of shoring and bracing and backfilling of voids with satisfactory materials.
  - 4. Removal of trash and debris.
- J. Slope grade away from building minimum 2 percent slope for minimum distance of 5 ft, unless noted otherwise.
- K. Backfill trenches to contours and elevations with unfrozen fill materials.
- L. Systematically backfill trenches to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- M. General: Uniformly grade areas of work including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
- N. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes.

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Grading CONTRACTOR to provide for placement of topsoil, as required, to the finish grades indicated on the drawings.

- O. Make grade changes gradual. Blend slope into level areas by rounding so as to avoid sharp grade changes.
- P. Repair or replace items indicated to remain damaged by excavation or filling.
- Q. Placement and Compaction: Place native onsite and imported fine grained backfill and fill materials in layers not more than 8 inches in loose depth and imported granular material in layers not more than 12 inches in loose depth or as recommended by the Geotechnical Engineer for the specific application.
  - 1. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content.
  - 2. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification.
  - 3. Do not place backfill or fill material on surfaces muddy, frozen, or containing frost or ice.
  - 4. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift. Contractor shall follow the Geotechnical Engineer's recommendations when back-filling immediately adjacent to walls.

**3.12 COMPACTION**

- A. General: Control soil compaction during construction providing minimum percentage of density specified for each area.
- B. Prior to fill placement or aggregate base course placement, the subgrade shall be proof-rolled with a fully loaded 10 to 12 yard dump truck. Any areas that pump, heave or appear soft shall be over excavated and backfilled a minimum of 12 inches (or as recommended by the Geotechnical Engineer) with approved fine grained structural or select imported granular fill material.
- C. Percentage of Maximum Density Requirements: Compact soil, fill and backfill to not less than that recommended in the Geotechnical Report. In the absence of a Geotechnical Report, compact to the following percentages of maximum dry density for soils which exhibit a well-defined moisture density relationship determined in accordance with ASTM D1557.
  - 1. On site Native Fine-Grained Structural Fill: Compact exposed subgrade where disturbed, and each layer of backfill or fill material to 92 percent of maximum dry density (MDD).
  - 2. Base Course (Pavements and Floor Slabs): compact top 12 inches of the subgrade below the pavement and the granular base course material to 92 percent of maximum dry density MDD.
  - 3. Non-Structural Landscape Fill: Compact each layer of fill material to 90 percent of MDD.

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4. Trench Backfill: Compact the pipe base and pipe zone as recommended by the geotechnical report and per manufacturer recommendations. Contractor shall take precautions so as to not over compact the pipe zone causing damage to the utility pipe.
- D. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material. Prevent free water appearing on surface during or subsequent to compaction operations.
  1. Remove and replace, or scarify and air dry, soil material too wet to permit compaction to specified density.
  2. Soil material removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to satisfactory value.

**3.13 STOCKPILING**

- A. Stockpile materials on site at locations designated by OWNER.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Stockpile to 10 feet high maximum.
- E. Prevent intermixing of soil types or contamination.
- F. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

**3.14 STOCKPILE CLEANUP**

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.
- B. Leave unused materials in neat, compact stockpile.
- C. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

**3.15 QUALITY CONTROL/TOLERANCES**

- A. General: The CONTRACTOR is responsible for preparing and scheduling all required testing activities.
- B. Quality Control Testing During Construction: Allow Geotechnical Engineer and soil testing service retained by the OWNER to observe, test and approve subgrades and fill layers before further construction work is performed.

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- C. If in the opinion of the OWNER'S REPRESENTATIVE, based on Geotechnical Engineer reports and observations of subgrades and fills which have been placed are below specified density, provide corrective work as required to reach specified density at no additional expense.
- D. Grading Surface of Fill Under Building Slabs and Pavement: Grading smooth and even, free from voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of ½ inch from design elevation and variations to within ½ inch when tested with a 10-foot straight edge.
- E. Top Surface of Subgrade: Plus or minus 1 inch from required elevation.
- F. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.
- G. Perform laboratory material tests in accordance with ASTM D1557.
- H. Perform in place compaction tests in accordance with the following:
  - 1. Density Tests: ASTM D1557, and ASTM D2922.
  - 2. Moisture Tests: ASTM D3017.
- I. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- J. Frequency of Tests:
  - 1. Trench Backfill – As required by the geotechnical engineer or 1 test every 50 feet and every 3 feet of vertical backfill at a minimum.
  - 2. Structural Fill – as required by the geotechnical engineer or 1 test every 2 vertical feet or 500 yd<sup>3</sup> which ever requires more testing.
- K. Proof roll compacted fill surfaces under slabs-on-grade, paving, and overall site grading. Request visual inspection of bearing surfaces by Geotechnical Engineer before installing subsequent work.

**END OF SECTION****DRAFT**

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

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes: Furnishing, placing and maintaining all erosion control and protective materials including but not limited to the following:
1. Construction Entrance.
  2. Filter Fabric.
  3. Sediment Fencing.
  4. Bio-Bags.
  5. Straw Wattles
  6. Inlet Protection.
  7. Mulch.
  8. Plant Materials.
  9. Maintenance
- B. Related Sections:
1. Section 01 33 00 - Submittal Procedures
  2. Section 31 05 13 - Earthwork.
  3. Section 32 91 19 – Landscape Grading, Topsoil, and Soil Preparation
  4. Section 32 93 00 – Planting
  5. Section 33 41 00 – Storm Utility Drainage Piping.
  6. Contract Documents - Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division I Specification Sections.
  7. Document: 1200C Oregon DEQ Construction Stormwater General Permit.
  8. Document: Geotechnical report.

#### **1.2 REFERENCES**

- A. ASTM International:
1. ASTM C127 - Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
  2. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft-lbf/ft<sup>3</sup>.
  3. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
  4. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- B. 1200-C Oregon DEQ Best Management Practice Manual.
- C. “OSSC” Refers to the State of Oregon/APWA Standard specifications for Construction.

### **1.3 SUBMITTALS**

- A. **Section 01 33 00 - Submittal Procedures:** Requirements for submittals.
- B. Samples:
  - 1. Submit two samples of rock, minimum 5 tons each or one-half total project quantity, whichever is smaller. Provide one sample in place at construction site and provide another sample at quarry. Construction site sample may be incorporated into the Work. Samples will be used as reference for judging size, and graduation of rock supplied and placed.
- C. Product Data: Submit manufacturer data for materials used in Work:
  - 1. Sediment Fencing
  - 2. Biobags
  - 3. Inlet Protection
  - 4. Straw Wattles
- D. **Section 01 78 00 - Closeout Submittals:** Requirements for submittals.

### **1.4 QUALITY ASSURANCE**

- A. **Section 01 78 00 - Closeout Submittals:** Requirements for submittals.
- B. Perform Work in accordance with these specifications and the Oregon DEQ 1200CN Permit requirements.
- C. Perform Work in accordance with OSSC.
- D. Maintain one copy of each document on site.

### **1.5 PRE-INSTALLATION MEETINGS**

- A. Contractor shall coordinate pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section. Minimum attendees shall be the Contractor's site superintendents and the project's certified erosion control inspector.

### **1.6 ENVIRONMENTAL REQUIREMENTS**

- A. **Section 01 60 00 - Product Requirements:** Environmental conditions affecting products on site.

### **1.7 REGULATORY REQUIREMENTS**

- A. Conform to the City of North Plains and Clean Water Services requirements.

- B. Contractor shall adhere to the requirement of the Oregon DEQ 1200CN permit requirements and shall supplement the erosion control plan requirements to meet the specific site demands to prevent sediment laden water from leaving the site.

## **1.8 PROJECT CONDITIONS**

- A. Erosion control is required for this Project and is the responsibility of the Contractor to provide, install and maintain erosion control measures under this Contract. Effective erosion control measures must be installed and maintained to meet jurisdictional requirements. The governing authority having jurisdiction may, at any time, order corrective action and stoppage of work to accomplish effective erosion control. Erosion control measures must be installed prior to commencing Work in this section, and shall be protected and maintained in effective, functioning condition during the construction period and through final acceptance.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Gravel Construction Access: All material furnished for “Gravel Construction Entrances” shall be clean pit run with size as indicated on the drawings.
- B. Sediment Fences: Woven construction fabric specifically designed to control sediment run-off. Acceptable material is Amoco 1380 Silt Stop, or equal.
- C. Posts/Stakes:
  - 1. 2"x2" standard or better wood posts (sediment fences & straw bales).
  - 2. Steel fence posts (sediment fences).
- D. Inlet Filter Sack: Woven construction fabric specifically designed to control sediment run-off. Acceptable material is ACF Environmental Siltsack® or approved equal.
- E. Bio-Bags: Clean 100% recycled wood product waste. Size of bag to be 18x8x30-inches and weigh approximately 45 pounds and made of ½-inch plastic mesh.
- F. Straw Wattles: Wheat straw, rye grass straw, coconut, or excelsior wattles as approved by the Governing Authority having Jurisdiction.
- G. Hydro-Seeding: Seed, fertilizer and mulch acceptable to the landscape architect.
- H. Straw Mulch: Clean, sterile dry oat or wheat straw free from weeds and other foreign matter detrimental to plant life. Hay or chopped cornstalks are not acceptable. Ensure that the mulch does not contain noxious weed seeds of any species.



- I. Planting Materials:
  - 1. Seeding: As indicated in the landscape drawings and specifications.
  - 2. Trees, Shrubs and Groundcover: As indicated in the landscape drawings and specifications.

## **2.2 SOURCE QUALITY CONTROL (AND TESTS)**

- A. Section **01 40 00 - Quality Requirements**: Testing, inspection and analysis requirements.
- B. Perform tests on cement, aggregates, and mixes to ensure conformance with specified requirements.
- C. Make rock available for inspection at producer's quarry prior to shipment. Notify Engineer at least seven days before inspection is allowed.
- D. Allow witnessing of inspections and test at manufacturer's test facility. Notify Engineer at least seven days before inspections and tests are scheduled.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Contractor shall coordinate verification of existing conditions before starting work.
- B. Verify compacted subgrade is acceptable and ready to support devices and imposed loads.
- C. Verify gradients and elevations of base or foundation for other work are correct.
- D. Verify that all areas to receive erosion control measures are prepared and ready for Work in this section.
- E. The contractor shall comply with all regulatory requirements.
- F. Prior to performing any site clearing or earthwork operations, install all sediment and erosion control devices as early as practical and as shown on the Drawings.
- G. Do not place riprap over frozen or spongy subgrade surfaces.

### **3.2 CONSTRUCTION ACCESS (ENTRANCE)**

- A. Install as indicated on the drawing details.

### **3.3 SEDIMENT FENCING**

- A. The CONTRACTOR shall place an adequate sediment barrier around the site perimeter as shown on the Drawings.

- B. Place sediment barriers at toes of slopes. Embed sediment fences 6 inches below ground. Embed straw bales 4 to 6 inches.
- C. Provide posts at 6-foot maximum spacing for sediment fences.
- D. Provide (2) stakes per straw bale driven a minimum of 12-inches into the ground.
- E. Provide filter fabric inlet barrier around the on-site catch basins and area drains per drawing details.

### **3.4 BIO-BAGS/STRAW WATTLES**

- A. Install as indicated on drawing details.

### **3.5 INLET PROTECTION**

- A. Install as indicated on drawing details.

### **3.6 MULCH**

- A. Install mulch to accomplish the following:
  - 1. Seeded and Planted Areas: Install as indicated in landscape specifications for seeded and planted areas.
  - 2. Temporary Erosion Control: Install minimum 2-inch thickness over areas requiring temporary erosion control. Install additional devices as soon as reasonably possible.
  - 3. Additional Protection: Install in conjunction with other approved erosion control measures, as specified, to provide additional protection per project conditions.

### **3.7 SITE STABILIZATION**

- A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.
- B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.
- C. Stockpile and waste pile heights shall not exceed 20 feet. Slope stockpile sides at 2:1 or flatter.
- D. Stabilize any disturbed area of affected erosion control devices on which activity has ceased and which will remain exposed for more than 20 days.
  - 1. During non-germinating periods, apply mulch at recommended rates.
  - 2. Stabilize disturbed areas which are not at finished grade and which will be disturbed within one year in accordance with Section 32 91 19 or per erosion control permit requirements.

- 3. Stabilize disturbed areas which are either at finished grade or will not be disturbed within one year in accordance with Section 32 91 19 permanent seeding specifications.
- E. Stabilize diversion channels, sediment traps, and stockpiles immediately.

### **3.8 FIELD QUALITY CONTROL**

- A. Section **01 40 00 - Quality Requirements and 01 78 00 – Closeout Submittals**: Field inspecting, testing, adjusting, and balancing.
- B. Inspect erosion control devices on a weekly basis and after each runoff event or as required by the Construction Stormwater Erosion Control Permit. Make necessary repairs to ensure erosion and sediment controls are in good working order.
- C. If tracking of soil off site continually occurs, construct temporary wheel wash or hose applied tire washing station.
- D. If the proposed erosion control measures are proving to be ineffective, contact the projects erosion control inspector for direction and remedial action.

### **3.9 CLEANING**

- A. Section **01 78 00 – Closeout Submittals**: Requirements for cleaning.
- B. When sediment accumulation in sedimentation structures has reached a point one-third depth of sediment structure or device, remove and dispose of sediment.
- C. Do not damage structure or device during cleaning operations.
- D. Do not permit sediment to erode into construction or site areas or natural waterways.
- E. Clean channels when depth of sediment reaches approximately one-half channel depth.

### **3.10 PROTECTION**

- A. **Protect at all times adjacent properties, areas and significant resources, including waterways and drainage courses, from erosion / sedimentation caused by Work in other sections.**
- B. Protect soil stockpiles from erosion by plastic sheeting (with sand bags) or other approved measures.
- C. When sediment accumulation in sedimentation structures has reached a point one-third depth of sediment structure or device or as required by the Construction Stormwater Erosion Control Permit, remove and dispose of sediment.
- D. Do not damage structure or device during cleaning / maintenance operations.

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- E. Repair and/or reestablish barriers that are damaged or temporarily removed immediately after such instance occurs.
- F. Remove and replace contaminated gravel with clean gravel as necessary to mitigate mud and dirt transported to public streets. Prior to construction of the asphalt pavement parking area, remove and replace contaminated gravel.
- G. Provide slope protection, seeding, and all other erosion control measures as specified and shown on the Drawings.

**END OF SECTION**

**SECTION 32 11 23 - AGGREGATE BASE COURSES**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Aggregate base course.
- B. Related Sections:
  - 1. Section 31 05 13 - Earthwork.
  - 2. Section 32 12 16 - Asphalt Paving.
  - 3. Section 32 13 13 – Rigid Pavement, Concrete Curbs & Walks
  - 4. Section 33 05 13 - Manholes and Structures
  - 5. Section 33 11 16 – Site Water Utility Distribution Piping
  - 6. Section 33 31 00 – Sanitary Utility Sewerage Piping
  - 7. Section 33 41 00 – Storm Utility Drainage Piping
  - 8. Contract Documents - Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division I Specification Sections.
  - 9. Document: Geotechnical report.

**1.2 REFERENCES**

- A. ASTM International:
  - 1. ASTM D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft-lbf/ft<sup>3</sup>.
  - 2. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
  - 3. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- B. OSSC refers to the current edition of the State of Oregon/ APWA, Standard Specifications for Construction.
- C. Regulatory Requirements: All materials and construction work within the public rights of way or for public facilities within easements shall be provided and constructed in accordance with the requirements and specifications of the Governing Authority having Jurisdiction.

**1.3 SUBMITTALS**

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Samples: Submit, in air-tight containers, 10 lb sample of each type of aggregate base rock to testing laboratory.
- C. Materials Source: Submit name of imported materials suppliers.

- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

#### **1.4 QUALITY ASSURANCE**

- A. Furnish each aggregate material from single source throughout the Work.
- B. Perform Work in accordance with OSSC standards.
- C. Maintain one copy of each document on site.

### **PART 2 PRODUCTS**

#### **2.1 MATERIALS**

- A. Provide aggregate for the various gradations indicated on the drawings meeting "OSSC" standards.
- B. Minimum requirements for rock: OSSC Section 02630. Rock for aggregate base course shall meet the State qualifications and meet the graduation designations indicated on the drawings.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Contractor shall coordinate verification of existing conditions before starting work.
- B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

#### **3.2 PREPARATION**

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place fill on soft, muddy, or frozen surfaces.

#### **3.3 AGGREGATE PLACEMENT**

- A. Spread aggregate over prepared substrate to a total compacted thickness indicated on the drawings.
- B. Place aggregate in maximum 6-inch layers and roller compact to specified density.
- C. Level and contour surfaces to elevations and gradients indicated.
- D. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Use mechanical tamping equipment in areas inaccessible to roller compaction equipment.
- G. Grade all areas to drain to collection points.
- H. Grade all ADA parking areas to no more than 2% cross-slope in any direction and access ways to no more than 2% cross-slope and no more than 5% running slope.

### **3.4 TOLERANCES**

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Maximum Variation from Surface Planarity: ¼ inch measured with 10-foot straight edge.
- C. Maximum Variation from Thickness: ¼ inch.
- D. Maximum Variation from Elevation: Plus, or minus ¼ inch.

### **3.5 STOCKPILING**

- A. Stockpile materials on site at locations designated by OWNER REPRESENTATIVE.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.
- D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

### **3.6 STOCKPILE CLEANUP**

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing of surface water.

### **3.7 FIELD QUALITY CONTROL**

- A. Section 01 4 00 - Quality Requirements and 01 78 00 – Closeout Submittals: Field inspecting, testing, adjusting, and balancing.
  - B. Compaction testing will be performed in accordance with ASTM D1557, ASTM D2922 and ASTM D3017 in accordance with the Geotechnical Engineering recommendations.
  - C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
  - D. Frequency of Tests: One test every 500 SY.
- END OF SECTION

**SECTION 32 12 16 - ASPHALT PAVING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Asphaltic concrete paving - wearing and base course.
  - 2. Surface sealer.
  - 3. Aggregate subbase course.
  - 4. Precast concrete parking bumpers.
- B. Related Sections:
  - 1. Section 01 33 00 - Submittal Procedures
  - 2. Section 31 05 13 - Earthwork
  - 3. Section 32 11 23 - Aggregate Base Courses
  - 4. Section 32 13 13 - Rigid Pavement, Concrete Curbs & Walks
  - 5. Section 33 05 13 - Manholes and Structures

**1.2 REFERENCES**

- A. Asphalt Institute:
  - 1. TAI – (The Asphalt Institute) – MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types
  - 2. TAI – (The Asphalt Institute) – MS-3 Asphalt Plant Manual.
  - 3. TAI – (The Asphalt Institute) – MS-8 Asphalt Paving Manual
  - 4. TAI – (The Asphalt Institute) – MS-19 - Basic Asphalt Emulsion Manual.
- B. ASTM International:
  - 1. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
  - 2. ASTM D2041- Standard test method for theoretical maximum specific gravity and density of Bituminous paving mixtures.
  - 3. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
- C. Oregon Department of Transportation/American Public Works Association
  - 1. OSSC refers to the current edition of the State of Oregon/ APWA, Standard Specifications for Construction.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Paving: Standard duty pavement per OSSC for the type shown on the drawings.

**1.4 SUBMITTALS**

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.



- B. Product Data: Submit product information and mix design.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

### **1.5 QUALITY ASSURANCE**

- A. **All Work in the public rights of way or easements dedicated to the public shall be in accordance with the local Governing Authority having Jurisdiction.**
- B. All Work outside public rights of way shall be in accordance with OSSC Specifications.
- C. Obtain materials from same source throughout.
- D. Maintain one copy of each document on site.

### **1.6 QUALIFICATIONS**

- A. **Installer:** Company specializing in performing work of this section with minimum 5 years documented experience.

### **1.7 ENVIRONMENTAL REQUIREMENTS**

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not place asphalt when ambient air or base surface temperature is less than 40, 50 or 60 degrees Fahrenheit based on the compacted thickness of pavement being placed, or if surface is wet or frozen as required per OSSC.
- C. Place bitumen mixture when temperature is not more than 15 degrees Fahrenheit below temperature at when initially mixed and not more than maximum specified temperature.

## **PART 2 PRODUCTS**

### **2.1 ASPHALT PAVING MATERIALS**

- A. Asphalt Cement: PG-64-22 per OSSC Specification Section 00744
- B. Aggregate: OSSC Specification Section 00744.10
- C. Aggregate Quality: OSSC Specification Section 00745.10
- D. Tack Coat: Use CSS-1 or CSS-1H
- E. Reclaimed Asphalt Pavement (RAP): Processed material obtained by milling or full depth removal of existing asphalt concrete pavements. No more than 30% RAP shall be allowed per OSSC Specification Section 00745.03.

## **2.2 ASPHALT PAVING MIX**

- A. Use dry material to avoid foaming. Mix uniformly.

## **2.3 ASPHALT PAVING SOURCE QUALITY CONTROL AND TESTS**

- A. Section **01 40 00 - Quality Requirements**: Testing, inspection and analysis requirements.
- B. Submit proposed mix design of each class of mix for review prior to beginning of Work.
- C. Job Mix Formula: Contractor to supply a current year mix design for the Level of pavement shown in the drawings per OSSC 00744.13.

## **2.4 PARKING BUMPERS MANUFACTURERS**

- A. Old Castle Precast Concrete Bumper Curb or approved equal.
  - 1. Size as shown on drawings.
  - 2. Dowels: Cut reinforcing steel ½ inch diameter inch long, pointed tip
  - 3. Adhesive: Epoxy

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Contractor shall coordinate verification of existing conditions before starting work.
- B. Verify compacted aggregate base is dry and ready to support paving and imposed loads.
- C. Verify gradients and elevations of base are correct.
- D. Verify gutter drainage grilles and frames, cleanout and manhole frames and lids are installed in correct position and elevation.
- E. Prior to pavement placement, the aggregate base shall be proof-rolled with a fully-loaded dump truck. Any areas that pump, heave or appear soft shall be over excavated and back-filled a minimum of 12 inches as well as placing a geotextile fabric such as Mirafi 600nx with imported fill material or as directed by the Geotechnical Engineer.

### **3.2 SUBBASE**

- A. Aggregate Subbase: Install as specified in Section 32 11 23

### **3.3 PREPARATION - TACK COAT**

- A. Apply tack coat on asphalt or concrete surfaces at uniform rate of 0.05-0.20 gal/sq.yd per OSSC Specification Section 00730.
- B. Apply tack coat to contact surfaces of curbs & gutters.

- C. Coat surfaces of manholes, catch basins, and cleanout frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

### **3.4 PLACING ASPHALT PAVEMENT - SINGLE COURSE**

- A. Prior to placement, Contractor shall review and check aggregate base rock to ensure that all areas are sloped adequately to drain to catchment points.
- B. Prior to placement, Contractor shall review and check aggregate base rock to ensure that all ADA parking areas do not slope more than 2% cross-slope in any direction.
- C. Install Work in accordance with OSSC standards for the level of pavement indicated on the drawings.
- D. Place asphalt within 24 hours of applying tack coat.
- E. Place to thickness as shown on the typical sections.
- F. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- G. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.
- H. Compact pavement by rolling to not less than 91% of ASTM D2041 (rice maximum density). Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- I. Minimum and maximum thickness of single courses shall be in accordance with OSSC standards.

### **3.5 PLACING ASPHALT PAVEMENT - DOUBLE COURSE**

- A. Prior to placement, Contractor shall review and check aggregate base rock to ensure that all areas are sloped adequately to drain to catchment points.
- B. Prior to placement, Contractor shall review and check aggregate base rock to ensure that all ADA parking areas do not slope more than 2% cross-slope in any direction.
- C. Place asphalt base course within 24 hours of applying tack coat.
- D. Place base course to compacted thickness as shown on the typical sections.
- E. Place wearing course within 24 hours of placing and compacting binder course. When binder course is placed more than 24 hours before placing wearing course, clean surface and apply tack coat before placing wearing course.
- F. Place base course to compacted thickness as shown on the typical sections.

- G. Compact each course by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- H. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.
- I. Compact pavement by rolling to not less than 91% of ASTM D2041 (rice maximum density). Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

### **3.6 BUMPER INSTALLATION**

- A. Install bumper units without damage to shape or finish. Replace or repair damaged units.
- B. Install bumper units in alignment with adjacent work.
- C. Fasten bumper units in place with 2 dowels for each unit bumper along with adhesive placed at contact points.

### **3.7 TOLERANCES**

- A. Section **01 40 00 - Quality Requirements**: Tolerances.
- B. Flatness: Maximum variation of ¼ inch measured with 10-foot straight edge.
- C. Scheduled Compacted Thickness: Within ¼ inch.
- D. Variation from Indicated Elevation: Within ¼ inch

### **3.8 FIELD QUALITY CONTROL**

- A. Section **01 40 00 - Quality Requirements**: Field inspecting, testing, adjusting, and balancing.
- B. Coordinate the Work with pavement placement and parking striping.
- C. The contractor shall have a field technician on site to establish the rolling pattern and determine the number of passes of each roller to provide the optimum compaction for the mixture. Once the rolling pattern has been established, the contractor shall maintain the pattern throughout.
- D. Test compaction and composition per OSSC Specifications. Minimum one set of compaction tests per 500 ton of asphalt and one composition test per 2000 square yards of material placed.
- E. Record asphalt temperature during placement and adhere to the breakdown and intermediate rolling temperature requirements.

**3.9 PROTECTION OF FINISHED WORK**

- A. Section 01 78 00 – Closeout Submittals: Protecting finished work.
- B. Immediately after placement, protect pavement from damage for until surface temperature is less than 140 degrees F. Permission from the OWNER'S REPRESENTATIVE is required to allow construction traffic on finished asphaltic pavements.

**END OF SECTION**

**SECTION 32 13 13 - RIGID PAVEMENT, CONCRETE CURBS & WALKS**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Concrete sidewalks.
  - 2. Concrete stair steps.
  - 3. Concrete integral curbs and gutters.
  - 4. Concrete Pavement.
- B. Related Sections:
  - 1. Section 31 05 13 - Earthwork
  - 2. Section 32 11 23 - Aggregate Base Courses
  - 3. Section 32 12 16 - Asphalt Paving
  - 4. Section 33 05 13 - Manholes and Structures.

**1.2 REFERENCES**

- A. American Concrete Institute:
  - 1. ACI 301 - Specifications for Structural Concrete.
  - 2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- B. ASTM International:
  - 1. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
  - 2. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
  - 3. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
  - 4. ASTM C33 - Standard Specification for Concrete Aggregates.
  - 5. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
  - 6. ASTM C150 - Standard Specification for Portland Cement.
  - 7. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
  - 8. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - 9. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
  - 10. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
  - 11. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  - 12. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

### **1.3 PERFORMANCE REQUIREMENTS**

- A. Paving: Designed for parking, light duty commercial vehicles and movement of trucks up to 60,000 lbs.

### **1.4 SUBMITTALS**

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Provide samples, manufacturer's product data, test reports, and materials' certifications as required in referenced sections for concrete and joint fillers, sealers and tactile warning textures & truncated dome product.
- C. Furnish certified reports of each proposed mix for each type of concrete at least thirty days prior to start of installation of the work of this section.

### **1.5 QUALITY ASSURANCE**

- A. **All Work in the public rights of way or easements dedicated to the public shall be in accordance with the local Governing Authority having Jurisdiction.**
- B. Perform Work in accordance with ACI 301.
- C. All codes referenced herein, shall include but not be limited to the following.
  - 1. American Society for Testing and Materials, ASTM
  - 2. American Concrete Institute
    - a. ACI 214 Recommended Practice for Evaluation of Strength Tests results; of Concrete
    - b. ACI 301 Details and Detailing of Concrete Reinforcement
    - c. ACI 305 Recommended Practices for Cold Weather Concreting
    - d. ACI 306 Recommended Practices for Hot Weather Concreting
    - e. ACI 308 Standard Practice for Curing Concrete
    - f. ACI 347 Recommended Practice for Concrete Formwork
- D. Maintain one copy of each document on site.
- E. NRMCA National Ready Mix Concrete Association, latest revision: Certificate of Conformance for Concrete Production Facilities.
- F. Obtain cementitious materials from same source throughout.

### **1.6 QUALIFICATIONS**

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum 3 years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum 5 years documented experience.

## **1.7 MOCKUP**

- A. Section 01 40 00 - Quality Requirements: Requirements for mockup.
- B. Construct mockup, 5 x 5 feet, including showing specified paving, joints, surface texture, exposed aggregate, etc as shown in the drawings.
- C. Incorporate accepted mockup as part of Work.

## **1.8 PRE-INSTALLATION MEETINGS**

- A. Contractor shall coordinate pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

## **1.9 ENVIRONMENTAL REQUIREMENTS**

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Do not place concrete when base surface temperature is less than 40 degrees Fahrenheit, or surface is wet or frozen.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Form Materials: Conform to ACI 301. Steel, wood or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
  - 1. Use flexible spring steel forms or laminated boards to form radius bends as required.
  - 2. Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.
- B. Reinforcing Materials:
  - 1. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 60.
  - 2. Fabricated Bar Mats: Welded or clip-assembled steel bar or rod mats, ASTM A 184. Use ASTM A 615, Grade 60 steel bars, unless otherwise indicated.
  - 3. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs. Provide slip pin dowels as a product commercially manufactured for this use.
  - 4. Supports for Reinforcement: Chairs, spacers, dowel bar supports and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels in place. Use wire bar-type supports complying with CRSI specifications.
- C. Concrete Materials:



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1. Portland Cement: ASTM C150, Type IA or IIA.
    - a. Use one brand of cement throughout Project unless otherwise acceptable to OWNER'S REPRESENTATIVE.
  2. Fly Ash: ASTM C 618; Type F.
  3. Normal-Weight Aggregates: ASTM C 33, Class 4, and as follows. Provide aggregates from a single source.
    - a. Maximum Aggregate Size: 1½ inches.
    - b. Do not use fine or coarse aggregates that contain substances that cause spalling.
    - c. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to OWNER'S REPRESENTATIVE.
  4. Water: Potable.
  5. Air Entrainment: ASTM C 260.
  6. Chemical Admixture: ASTM C 494
- D. Isolation Joint Materials:
1. ASTM D 994, preformed asphalt impregnated, ½ inch thick
- E. Joint Sealer Material:
1. A polymer, designed for gun application, containing no free Toluene Diisocyanate (TDI), complying with ASTM C 920, Standard Specification for Elastomeric Joint Sealants. Scofield LITHOSEAL Trafficalk-3G, color grey, or approved equal.
- F. Liquid-Membrane Forming and Sealing Curing Compound: Comply with ASTM C 309, Type I, Class A unless other type acceptable to OWNER'S REPRESENTATIVE. Moisture loss no more than 0.055 gr./sq.cm. when applied at 200 sq. ft./gal.
- G. Bonding Compound:
1. Acrylic or styrene butadiene base, re-wettable type.
- H. Epoxy Adhesive:
1. ASTM C 881, 2-component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade" and "Class" to suit project requirements
- I. Detectable Warning Texture: Provided as shown on Plans.
1. Texture: Diamond texture or Truncated dome style where shown on drawings.
  2. Pattern: Diamond or Domes to be arranged in an in-line pattern only.
  3. Application: Cast in Place or approved equal.
  4. Color: As shown on the drawings.

**2.2 CONCRETE MIX DESIGN**

- A. Prepare design mixes for each type and strength of normal-weight concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.

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1. Do not use the Owner's field quality-control testing agency as the independent testing agency.
  2. Limit use of fly ash to 25 percent of cement content by weight.
- B. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with the following properties:
1. Compressive Strength (28-Day):
    - a. Sidewalks and Curbs: 3300 psi.
    - b. Crosswalks in drive aisles: 4000 psi
    - c. Thrust blocks: 2,500 psi
  2. Slump Limit at Point of Placement: 4 inches  $\pm$  1 inch
    - a. Slump limit for concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches.
  3. Air Entrained: 5 percent  $\pm$  1%.
- C. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, project conditions, weather, test results or other circumstances warrant.
- D. Use accelerating admixtures in cold weather only when approved by the Engineer in writing. Use of admixtures will not relax cold weather placement requirements.
- E. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94

**2.3 SOURCE QUALITY CONTROL AND TESTS**

- A. Section 01 40 00 - Quality Requirements: Testing and Inspection Services:
- B. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of Work.
- C. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.
- D. Test samples in accordance with ACI 301.

**PART 3 EXECUTION****3.1 EXAMINATION**

- A. Contractor shall coordinate verification of existing conditions before starting work.
- B. Verify compacted granular base is acceptable and ready to support paving and imposed loads.
- C. Verify gradients and elevations of base are correct.
- D. Remove loose material from compacted base immediately before placing concrete.

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- E. Proof-roll prepared base surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

**3.2 PREPARATION**

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat surfaces of manholes, catch basin, and clean out frames with oil to prevent bonding with concrete pavement.
- C. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations.

**3.3 FORMING**

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.
- D. Set forms to required grades and lines, braced and secured. Concrete flatwork thickness is noted on plans and details. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
- E. Check completed formwork for grade and alignment to following tolerances:
  - 1. Top of forms not more than 1/4 inch in 10 feet.
  - 2. Vertical face on longitudinal axis, not more than 1/4 inch in 10 feet
- F. Clean forms after each use and coat with form release agent as required ensuring separation from concrete without damage.

**3.4 REINFORCEMENT**

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for placing and supporting reinforcement.
- B. Place reinforcement as indicated.
- C. Interrupt reinforcement at contraction/expansion joints.
- D. Place dowels and reinforcement to achieve pavement and curb alignment as detailed.
- E. Provide doweled joints 24 inches o.c. at transverse joints and interruptions of concrete with one end of dowel set in capped sleeve to allow longitudinal movement.

### **3.5 PLACING CONCRETE**

- A. Comply with requirements and with ACI 304R for measuring, mixing, transporting, and placing concrete.
- B. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- C. Place concrete by methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels and joint devices.
- D. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- E. Deposit and spread concrete in a continuous operation between transverse joints as far as possible. If interrupted for more than ½ hour, place a construction joint.
- F. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.
- G. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
  - 1. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to OWNER'S REPRESENTATIVE.
- H. Curbs: When automatic machine placement is used for curb placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.
- I. Slip-Form Pavers: When automatic machine placement is used for paving, submit revised mix design and laboratory test results that meet or exceed requirements. Produce paving to required thickness, lines, grades, finish and jointing as required for formed paving.
  - 1. Compact base and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.
- J. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

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- K. Cold-Weather Placement: Comply with provisions of ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 degrees F (4 degree C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F (10 degrees C) and not more than 80 degrees F (27 degrees C) at point of placement.
  2. Do not use frozen materials or materials containing ice or snow.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix design.
- L. Hot-Weather Placement: Place concrete complying with ACI 305R and as specified when hot weather conditions exist.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 degrees F (32 degrees C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
  3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.
- M. Ensure reinforcement, inserts, embedded parts and formed joints are not disturbed during concrete placement.
- N. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- O. Place concrete to pattern indicated.

**3.6 JOINTS**

- A. General: Construct isolation, weakened-plane (contraction), and construction joints true to line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.
- B. When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.
- C. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints, sectioning concrete into areas as shown on Drawings or at approximate 10' intervals if not shown. Align curb, gutter, and sidewalk joints. Construct weakened-plane for a depth equal to 1/4 concrete thickness, as follows:
1. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.

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2. Inserts: Use embedded strips of metal or sealed wood to form weakened-plane joints. Set strips into plastic concrete and carefully remove strips after concrete has hardened.
- D. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for more than 2 hour, except where such placements terminate at isolation joints.
  1. Construction joints as shown or, if not shown, use standard metal keyway-section forms.
  2. Where load transfer-slip dowel devices are used, install so that one end of each dowel bar is free to move.
- E. Isolation Joints: Provide pre-formed asphalt impregnated joint material.
  1. Locate expansion joints abutting catch basins, manholes, inlets, structures, foundations, footings, and other fixed objects, unless otherwise indicated, and as shown on Drawings.
  2. Locate expansion joints at a maximum of 45' o.c. for continuous sidewalks and within 8 - 16 feet from ends of walks which abut curbs or as shown on drawings.
- F. Extend joint fillers full width and depth of joint, not less than 1-inch or more than 2-inches below finished surface for placement of backer rod and joint sealer. Place joint filler between paving components and building or other appurtenances. Recess top of filler as shown in drawings for sealant placement.
- G. Finish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.
- H. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.
- I. Fillers and Sealants: Apply joint sealant to all joints in pedestrian or vehicular traffic areas, in accordance with the Scofield Tech-Data Bulletin S-404-3G, or equal if a different sealer is approved for use.
- J. Provide keyed joints as indicated.

**3.7 FINISHING**

- A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.
- B. After floating, test surface for trueness with a 10-foot straightedge. Distribute concrete as required to remove surface irregularities, or abrupt angles and refloat repaired areas to provide a continuous smooth finish, true to within 1/4 inch in 10 feet.
- C. Work edges of gutters, back top edge of curb, and formed joints with an edging tool, and round to 2-inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

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- D. After completion of floating and when excess moisture or surface sheen has disappeared, complete troweling and finish surface as follows:
  - 1. Broom Finish: Broom finish by drawing a fine-hair broom across concrete surface perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to OWNER'S REPRESENTATIVE.
  - 2. Exposed Aggregate: Apply surface retarder where exposed aggregate finish is required. Wash exposed aggregate surface with clean water and scrub with stiff bristle brush, acid etch solution exposing aggregate to match sample panel.
- E. Sidewalk Paving: Light broom or Exposed aggregate where shown on drawings.
- F. Curbs and Gutters: Light broom.
- G. Inclined Vehicular Ramps: Broomed perpendicular to slope.
- H. Place curing compound/sealer on exposed concrete surfaces immediately after finishing.
- I. Do not remove forms for 24 hours after concrete has been placed, except where required for finishing. After form removal, clean ends of joints and point-up any minor honey-combed areas. Remove and replace areas or sections with major defects, as directed by OWNER'S REPRESENTATIVE.
- J. Place detectable warning texture/truncated domes per manufacture's recommendations.

**3.8 CURING**

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.
- B. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these.
- E. Curing/Sealer Compound: Apply uniformly in continuous operation according to manufacturer's instructions.

**3.9 JOINT SEALING**

- A. Separate pavement from vertical surfaces with 1/4 inch thick joint filler.



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- B. Place joint filler in pavement pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- C. Extend joint filler from bottom of pavement to within ¼ inch of finished surface.

**3.10 TOLERANCES**

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Maximum Variation of Surface Flatness: ¼ inch in 10 ft.
- C. Maximum Variation From True Position: ¼ inch.

**3.11 FIELD QUALITY CONTROL**

- A. Section 01 40 00 - Quality Requirements and 01 78 00 – Closeout Submittals: Field inspecting, testing, adjusting, and balancing.
- B. Three concrete test cylinders will be taken for every 100 or less cu yds of each class of concrete placed each day or as directed by OWNER'S REPRESENTATIVE.
- C. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.
- D. One slump and entrained air test will be taken for each set of test cylinders taken in accordance with ACI 301.

**3.12 REPAIR AND PROTECTION**

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Repair or replace broken or defective concrete, as directed by OWNER'S REPRESENTATIVE.
- C. Drill test cores where directed by OWNER'S REPRESENTATIVE when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement with Portland cement concrete bonded to pavement with epoxy adhesive.
- D. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just before final inspection.
- E. Do not permit pedestrian traffic over sidewalks for 7 days and vehicular traffic over pavement until 85 percent of design strength of concrete has been achieved. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

**END OF SECTION****DRAFT**



**SECTION 32 84 00 - IRRIGATION SYSTEMS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Irrigation system shall be installed by a contractor licensed and bonded to perform such work in the State of Oregon.
- B. Furnish all labor, tools, equipment, material, transportation and perform all operations necessary and incidental to proper execution and completion of the irrigation system installation in accordance with the Drawings and Specifications.
- C. The irrigation system shall be a complete and operable landscape irrigation system, constructed to grades, and comply in all respects with these Specifications and Drawings and recognized good practice industry standards. **Existing irrigation systems are assumed to be present on site and to have a dedicated irrigation service and double check valve from the well house with its own controller. This system shall be maintained and preserved for all existing irrigation on site. Contractor shall coordinate with the Owner and shall protect and replace and/or repair where necessary to ensure continuous irrigation control to all areas affected by work performed under this scope. The new irrigation system shall be separately sourced by diverting water from the vacated domestic water service line from the well house and a new double check valve and controller shall be installed in the well house to serve the new system. Final exact location shall be coordinated with the General Contractor and Owner. Prior to beginning any irrigation work, Contractor shall coordinate a pre-installation meeting with the Owner and General Contractor to test the existing system for functionality and to determine area of service. Contractor shall also test and verify available pressure and flow rates. Adjustments and/or repairs to the irrigation systems may be required based on the findings of these tests. After completion of irrigation work, contractor shall again test existing and new irrigation systems to ensure functionality to the satisfaction of the Owner.**
- D. Contractor shall test to confirm the static water pressure as per design. If the static water pressure is not within five (5) PSI of the design specified pressure the irrigation contractor will communicate this reading to the general contractor, the irrigation designer and Owner's Representative.
- E. Protect equipment, buildings, utilities, sidewalks, trees, landscaping monuments, markers, adjacent property, and work by others.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 33 00 - Submittal Procedures
- B. Section 31 05 13 - Earthwork
- C. Section 32 93 00 – Planting

### **1.3 RELATED WORK**

- A. Irrigation Contractor to install connections to new central controller system as per manufacturer's instructions. Coordinate final location with Owner's Representative.
- B. Sleeving – Install sleeving prior to paving. Coordinate sleeve installation with General Contractor.
- C. Install new double check valve for new irrigation system and test and confirm existing double check valve for existing systems meets current jurisdictional code requirements prior to irrigation system revisions/installation. Verify location with Owner's Representative.

### **1.4 REFERENCES**

- A. ASTM International:
  - 1. ASTM B32 - Standard Specification for Solder Metal
  - 2. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes
  - 3. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
  - 4. ASTM D2241 - Standard Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
  - 5. ASTM D1785 - Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
  - 6. ASTM D2466 - Standard Specification for Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
  - 7. ASTM D2564 - Standard Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Piping Systems
  - 8. ASTM F876 Standard Specification for Cross-linked Polyethylene (PEX) Tubing
  - 9. ASTM F1960 Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing
  - 10. Uponor Professional Plumbing Installation Guide, current edition
  - 11. Uponor Plumbing Design Assistance Manual, current edition.
- B. National Electrical Manufacturers Association:
  - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

### **1.5 REGULATORY REQUIREMENTS**

- A. All work specified and detailed will conform to the *Uniform Plumbing Code* and the *National Electric Code* as modified by the State of Oregon unless more stringent requirements are specified.
- B. **The contractor will be responsible for obtaining all necessary electrical and plumbing permits and including those costs into the bid price.**

### **1.6 SUBMITTALS**

- A. The contractor will provide to the Owner's Representative a record of all equipment and supplies within 30-days after the award of the contract, and before any construction begins. Submit catalog performance data with product name and model number.

- B. Any change in materials, equipment or the design, will be submitted in writing to the Owner Representative's for approval.
- C. After completion of construction, submit neat and legible As-Built drawings as 'Record Drawings' to the Owner's Representative. Dimension and note all underground work vertically and horizontally. Measure from a permanent structure for location after burial.
- D. Submit two copies of maintenance & operation manuals, parts list, warranty information, specification sheets, winterization instructions, precipitation rates and programming schedule.

### **1.7 PRE-INSTALLATION MEETINGS**

- A. Contractor shall coordinate pre-installation meeting. At a minimum this meeting shall test the existing irrigation system for functionality, condition, and service area; determine final locations for the new irrigation system connection, double check valve, and controller to the vacated domestic water line from the well house; and verify system water pressure and flow rates.
- B. Convene minimum one week prior to commencing work of this section. Minimum attendees shall be the Contractor's site superintendents, General Contractor, the owner, and the project's irrigation installer.

### **1.8 SYSTEM DESCRIPTION**

- A. Central controller, metal indoor housing cabinet, weather-based control system as indicated on the Drawings. Controller shall be located in existing pump house or as directed by the Owner. Coordinate exact location with Owner's Representative.
- B. Source Power: 110-volt, single phase or per manufacturer's recommendations.
- C. Double-check valve assembly, flow sensor, master valve, weather sensor, grounding and surge equipment.
- D. Sleeving
- E. Quick Coupler Valves
- F. Underground irrigation system, PVC piping, sprinklers and rotators, bubblers, and low-flow heads as indicated on the Drawings.

### **1.9 QUALIFICATIONS**

- A. Installer: The Contractor installing work covered by this Specification must be a state licensed and bonded Contractor. Contractor must be experienced in work of best-accepted trade practices and have equipment and personnel adequate to perform the work specified. Contractor must be familiar and comply with applicable governing regulations.
- B. The firm shall be Oregon Landscape Contractor Association (OLCA) certified with a Certified Landscape Technician in irrigation installation and has at least four years of experience in irrigation system installation.

**1.10 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged packaging with identification labels intact, or alternative, secure packaging provided by distributor.
- B. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
- C. The Owner or their Representative reserves the right to inspect and reject or order repair of irrigation system at any time until final review and acceptance.

**1.11 WARRANTY**

- A. Contractor shall guarantee workmanship, materials, and performance of installation for at least 2-years from date of Final Acceptance. Comply with terms of manufacturer's warranty to ensure product performance.
- B. The Contractor will be responsible for maintaining the irrigation system and protecting it from damage (at no cost to the Owner Representative) until the date of final acceptance. This includes damage caused by vandalism or adverse weather conditions.
- C. Piping system warranty shall apply to potable water distribution and water service systems constructed of pipe and fitting products sourced from the same manufacturer.
- D. The Contractor will be responsible for the programming of the new controller, the proper watering of all plants and any damage from over or under watering until the date of final acceptance.
- E. Repair any settling of backfilled trenches, restore damaged turf, plants and paving (caused by settling), during the warranty period at no cost to the Owner's Representative.

**1.12 EXISTING UTILITIES**

- A. The Contractor will, at their expense, have all existing utilities located at job sites prior to commencement of work.
- B. The Contractor will protect any utilities that remain in place. Any located utilities damaged during construction will be repaired at the cost of the Contractor.
- C. If utilities not located are damaged during construction, the Contractor will cooperate with utility company during the utility company repairs.

**1.13 EXTRA MATERIALS**

- A. The Contractor will provide the Owner Representative (at no extra cost) with two controller keys, two quick coupler keys with hose swivels, two adjustment / removal tools for each different type of sprinkler head and two gate valve keys.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. All products will be new and of types and models shown on the plans or as specified herein.
- B. All products will be obtained from in state, local suppliers.
- C. Substitutions must be approved by the Owner's Representative and be of equal function, quality, and compatible with other irrigation system components.

### **2.2 PIPE**

- A. Plastic pipe for main line 4" and smaller will be PVC (polyvinyl chloride) Schedule 40, bell end, continuously bearing the seal of NSF International and complying with the requirements of ASTM D -1785.
- B. Depth of mainlines will be 18" min. to 24" max. (Top of pipe).
- C. Plastic pipe for lateral lines will be PVC (polyvinyl chloride) Class 200, SDR 21, bell end, continuously bearing the seal of NSF International and complying with the requirements of ASTM D -1784, D-2241.
- D. Depth of lateral lines will be 12" min. to 18" max. Lateral lines should be installed to conform to the depth of the head being installed.
- E. In all pipe installations, the manufacturer's printed seal will be visible.
- F. In all cases, installation of two or more pipes in the same trench is not permitted.
- G. Plastic pipe for sleeves under paved areas, will be PVC (polyvinyl chloride) Schedule 40, bell end, continuously bearing the seal of NSF International and complying with the requirements of ASTM, D -1785. Sleeves will be a minimum of 6" in diameter or twice the diameter of the mainline or lateral line, whichever is larger.
- H. Plastic nipples will be PVC (polyvinyl chloride) Schedule 80, NSF International-approved pipe, threaded both ends (TBE) or threaded one end (TOE) and complying with the requirements of ASTM D-1785.
- I. Metal pipe will be copper tube type K.
- J. Metal nipples will be brass.
- K. NOTE: No galvanized pipe will be allowed underground.

### **2.3 FITTINGS**

- A. Plastic fittings will be solvent weld PVC (polyvinyl chloride) Schedule 40, Type 1, I.P.S., NSF International- approved meeting requirements of ASTM D- 2466.
- B. Metal fittings will be 125-PSI bronze.
- C. NOTE: No galvanized fittings will be allowed underground.

## **2.4 CEMENT AND PRIMER**

- A. PVC solvent cement will be used on all solvent weld fittings. Weld-On 711 or approved cement equal meeting NSF International Standards for Type I and II PVC through 6-inch pipe and meeting requirements of ASTM D- 2564.
- B. PVC solvent primer will be used on all solvent weld fittings. Weld-On P-70 or approved primer equal meeting the requirements of ASTM F-656, with purple color.

## **2.5 THREAD SEALANT**

- A. All PVC threads will be sealed with a Teflon sealant.
- B. On main line threads (under continuous pressure) Rectorseal T+2 or approved equal for PVC.
- C. On lateral lines (at heads) all threads will be sealed with three wraps of Teflon tape, meeting requirements of MIL-T-27730A.
- D. Only Teflon tape will be used at plastic valves and heads per manufacturer's specifications.

## **2.6 BACKFLOW PREVENTOR**

- A. Double-check valve assembly per water purveyor and/or jurisdictional authority requirements. Confirm suitability of existing double-check valve for existing irrigation systems on site and supply new double-check valve assembly for new irrigation systems.
- B. Install PVC or brass unions or cast-iron flanges on both sides of the device to match pipe size.
- C. It is the responsibility of the contractor to obtain permits and allow inspection by the water purveyor and the plumbing inspector.
- D. The Contractor will, at their cost, have the initial Backflow Assembly Test Report performed by a State certified tester immediately after installation. Copies of the Test Report will then be immediately submitted to the water purveyor and Owner Representative.
- E. If the device fails its initial test, the contractor will have the device repaired and retested at the contractor's expense.
- F. Valve box sizes for double-check valve assemblies:
  - 1. 2"- Brooks green plastic 1730VB-18. A 1730 E8 extension will be used if needed to set to grade. Two valve boxes will be used and set base to base to create a void for double check and to allow a technician to stand in and around device.
- G. Depth of devices: On 3/4" to 2" sizes the depth of the devices will be 24". The final determination will be with the water purveyor and/or the jurisdictional authority.

## **2.7 VALVES**

- A. Isolation Valves:
  - 1. 2" and smaller will be heavy duty brass globe or manual angle valves. 125-PSI min. with standard seat, threaded ports and a cross handle on the stem.

2. 3" and larger valves will be 125 PSI min. cast iron, flanged and have square top nut on the stem.
- B. Valve Boxes:
  1. A Highline (Armor) or Rain Bird 12" standard box with extensions is to be installed on 3" and smaller valves.
  2. A Highline (Armor) or Rain Bird jumbo box with extensions is to be installed on 4" and larger valves.
- C. Manual drains will be installed on the low points of the mainline with two (2) cubic feet of 3/4" drain rock. Champion 3/4" brass angle valve with rising swivel (200RS-075) will be used. A 3/4" X 4" PVC nipple will be installed into the drain rock from the bottom of the valve. A Highline (Armor) or Rain Bird 10" round box will be used over this valve.
- D. Automatic control valves as indicated on the Drawings. Accu sync pressure regulator shall be installed where pressure regulation is required. Valve size is noted in valve schedule on Drawings. A Highline (Armor) or Rain Bird 12" standard box will be installed on 1" automatic valves. A Highline (Armor) or Rain Bird jumbo box will be installed on 1½", 2" and 3" automatic valves.
- E. Quick coupler valves as indicated on the Drawings, installed in a Highline (Armor) or Rain Bird 10" round box with one (1) cubic foot of 3/4" drain rock. Quick couplers will be installed with PVC swing joint fittings and nipples of the same size as the threading of the quick coupler. Quick couplers will be secured to a 1" or 1½" aluminum angle iron 30" long with #32 or #36 stainless steel clamps.
- F. Pressure Regulator (as needed) shall be Wilkens, Watts, or Conbraco top entry with double unions, as approved.

## **2.8 VALVE BOXES**

- A. All valves, wire splices and ground rods will have valve boxes with covers installed over them.
- B. All valve boxes will be from:
  1. Highline Products, 131 Hartwell Ave., Lexington, MA 02421 USA or
  2. Rain Bird Corporation 970 West Sierra Madre Ave. Azusa, CA 91702.
- C. The valves will have complete access for maintenance.
- D. The bottom of the box will be below the bottom of the valve to prevent soil from covering valve body.
- E. All valve boxes will have a base of 3/4" drain rock. Each size of box will have a corresponding amount of rock.
  1. 10" round box: one (1) cubic foot
  2. 12" standard box: two (2) cubic feet
  3. Jumbo box: three (3) cubic feet
  4. Brooks 1730: four (4) cubic feet
- F. Protect rock from contamination with filter fabric.



- G. Install box with a 2" space over the pipe.
- H. All boxes in turf areas will be installed flush to grade and use extensions if needed.
- I. All boxes in shrub areas will be installed 2" above grade and use extensions if needed, to accommodate the application of bark mulch.

## **2.9 SPRINKLER HEADS**

- A. All popup spray body sprinkler heads will be by manufacturer as indicated on the Drawings or as otherwise approved. See schedule on Drawings for proper nozzle sizes. All heads will have a sealing check device installed to prevent low head drainage. Locate heads no closer than three inches (3") from any adjacent walk, drive or road (paved or gravel).
- B. All rotor heads will have swing joints of the same thread size installed or as recommended by manufacturer.
- C. Six-inch pop-up heads will be installed in turf areas and planting beds.
- D. All heads in shrub beds will be installed 2" above grade to accommodate the application of bark mulch.
- E. All heads in turf areas will be installed to grade per manufacture's specifications. Refer also to irrigation details on Drawings.

## **2.10 CONTROLLERS**

- A. Controller to be weather- based central controlled system as specified in the Drawings. Install per manufacturer's specifications.
- B. Controller station size and location as noted on the Drawings and approved by the Owner.
- C. Grounding: To be installed per manufacturer's specifications.
- D. Interior housing cabinet installed per manufacturer's specifications.

## **2.11 ELECTRICAL**

- A. Confirm and coordinate power source for irrigation system with Owner and General Contractor.
- B. All wiring shall follow the "National Electric Code" as modified by the State of Oregon unless more stringent requirements are specified.
- C. All primary power connections and disconnects shall be performed by a state-certified electrician at the contractors' expense and inspected by the proper jurisdictional authority.
- D. All automatic remote-control valves, including master valves, shall be wired with single strand copper, UL approved for direct burial, AWG (UL) Type UF, 600 V, sized per manufacturer's recommendations -14 Gauge minimum.
- E. All valve wire connections shall be 3M DBY / DBR.
- F. At each valve, a three (3) foot length of wire shall be provided neatly coiled.



- G. The wire run shall be installed along the side of the mainline at the bottom of the trench
- H. All valve field wire splices made will be installed in valve boxes, with no splices between valve boxes and valve boxes and controllers.

## **2.12 CONCRETE THRUST BLOCKS**

- A. Install concrete thrust blocks where the mainline changes direction at ells and tees and where the irrigation main ends.
- B. Install thrust blocks on all mainline 2 1/2" and larger. Pour thrust blocks against pipe and firm undisturbed soil with at least one cubic foot of concrete.
- C. Thrust blocks must cure for five (5) days before mainline pressure test.

## **PART 3 - EXECUTION**

### **3.1 IRRIGATION SYSTEM – INSPECTION PROCEDURE**

- A. Owners Representative may request inspection at any time during installation of irrigation system including the following milestones:
  - 1. Pre-construction Static Pressure Test
  - 2. Layout
  - 3. Excavation
  - 4. Mainline and Wire Installation
  - 5. Mainline Flushing
  - 6. Automatic Valve Installation
  - 7. Mainline Pressure Test
  - 8. Lateral and Swing Joint Installation
  - 9. Lateral Flushing and Head Installation
  - 10. Controller, Primary Power Installed, and Grounded
  - 11. Valve and Controller Wiring
  - 12. Controller Stations Wired as per Design
  - 13. Backfilling of Trenches
  - 14. Finish Work
  - 15. Heads, Valves and Controller Match Specifications
  - 16. Head and Valve Box Grade
  - 17. Head Adjustment
  - 18. Submit Copy of Back Flow Assembly Test Report
  - 19. Submit "As Built" Drawings

### **3.2 INSTALLATION PROCEDURE**

- A. No work shall be covered or enclosed until it has been inspected, tested, approved and signed off on the checklist. A 24-hour notice for approval shall be given. The Owner's Representative will maintain the inspection checklist.
- B. Before construction begins contractor will confirm design static pressure. A change in more than five (5) PSI may require a redesign. Contractor will notify Owners Representative of this difference.

- C. Layout: Stake, flag and/or paint the location of all heads, valves and piping according to the schematic design shown on the drawings. The layout is then to be approved.
- D. Excavation shall proceed after layout approval. If during excavation, a large amount of unknown material (asphalt, concrete, wire, steel, etc.) is uncovered, the debris shall be removed from site, at Contractor expense. Bottom of trench shall be free of rocks, asphalt, concrete, wire, steel and any other debris. Trenching is the preferred method for pipe installation. Pipe pulling is only allowed when the soils are known to be clean and free of debris. Hand trench around existing tree roots of 2" and larger when encountered. Pipe shall have firm and uniform bearing on all pipe runs to prevent uneven settlement. Wedging or blocking of pipe is not permitted.
- E. Mainline, thrust blocks and isolation valves shall be installed according to the specifications. Valve wiring will be installed as per specifications and details. The mainline installation is then to be approved.
- F. The mainline is to be flushed before the installation of the automatic remote-control valves. Soil may be placed in trenches between fittings to insure the stability of the line under pressure. Thoroughly flush all mainline pipe. The flushing is then to be approved.
- G. The mainline is to be pressure tested, after valve installation, with the pipe filled with water and all air expelled. Minimum pressure test shall be 100 PSI without losing three (3) PSI over a two-hour period. Pressure can be achieved with a pump but shall not be maintained with a pump. Supply certified pressure gauge during testing. Detect and repair all leaks and retest until approval is granted.
- H. The lateral lines, swing joints and flexible pipe joints shall then be installed and then approved.
- I. The lateral lines shall be thoroughly flushed to remove all debris and expel all air from the piping. The flushing is then to be approved.
- J. Delay complete backfilling until pressure tests have been accepted. Backfill, settle with water and compact trenches in 6" lifts with material free of rocks and debris. Backfilling will then be approved.
- K. The installation of valve boxes and heads shall be inspected and approved.
- L. The installation of all wiring at valves and controller shall be inspected and approved.
- M. Valve pressures will be adjusted. The contractor will then adjust all heads. The head adjustment shall be inspected and approved.
- N. During a walk through with the Contractor and the Owners Representative a system test will be performed to establish a final punch list. All items on the punch list will be corrected by the Contractor to the Owner Representative's satisfaction.
- O. Signing of the warranty will begin at date of final acceptance.

### **3.3 PIPE AND FITTINGS**

- A. All solvent weld cement joints are to be clean, dry and follow all manufacture's specifications. All cuts are to be square and debarred.

- B. No solvent welding of PVC pipe will be permitted in freezing weather. In rainy weather, solvent weld PVC pipe only under cover.
- C. All solvent weld joints are to be given at least 24-hours cure time before testing.
- D. No fittings are to be closer than 12" apart.
- E. All mainline threaded fittings will be applied with approved paste, hand tightened, and tool tightened with no more than two (2) turns.
- F. All sleeving is to be marked and taped over during and after construction to keep soil out of sleeves.
- G. All swing joints will be assembled and installed per manufacturer's specifications.

### **3.4 VALVES**

- A. All systems will have a brass angle valve with union installed before the automatic valve. On the downstream side of the valve, a MPT X SOC union will be installed. All fittings, unions, angle valve and nipples will match valve size.
- B. Do not use Teflon paste on automatic plastic valves. Teflon tape will be used on valve threads.
- C. Only one (1) valve per valve box unless otherwise indicated.

### **3.5 HEADS**

- A. All heads are to be installed per Specifications and manufacturer's instructions after lateral flushing.
- B. Contractor will use Teflon tape only on all head threads.
- C. Install heads called for in the Irrigation Schedule at locations shown on Drawings. Some field adjustment may be necessary to achieve desired coverage. Written notification and approval are required before making any significant changes.
- D. Heads are to be adjusted not to water walks, streets or other pavement.

### **3.6 CONTROLLERS**

- A. Controller shall be installed in existing well house for new irrigation system. Final location of controller shall be determined by the Owner. Existing controllers shall be maintained for existing irrigation systems.
- B. All valve and communication wire shall be installed in a clean and neat manner into all equipment.
- C. The Contractor will note valve number, location, run time and program on the label affixed to the controller door.
- D. The Contractor will have a Megger test performed on the installed specified ground rod to verify proper installation.
- E. Installation of controller and other irrigation related equipment shall not damage, interfere, or restrict access to other systems located within the existing well house.

**3.7 CLEAN UP**

- A. Remove all debris, boxes, wrappings, excess material and equipment before final walk through and leave area in a clean and neat condition as good or better than before construction.
- B. The Contractor will complete site restoration, including reestablishment of trenches and all disturbed areas, with seed mix as specified on the Drawings. If the season of the year does not permit viable seed establishment, then restoration will be completed with sod as approved.
- C. Clean up and restoration will be done at Contractor's expense.

**END SECTION**

**SECTION 32 91 19 - LANDSCAPE GRADING, TOPSOIL, AND SOIL PREPARATION**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. This section covers all work necessary to furnish and place topsoil mixes, and general preparation of planting areas as denoted on the Drawings, including:
  - 1. Soil preparation and testing
  - 2. Fertilizing
  - 3. Clean up.
- B. All disturbed areas to receive soil preparation and specified landscape treatment (trees, shrubs, groundcover, grass seed mix, etc.) for establishment of permanent erosion control on all areas of the project site. Installation shall comply in all respects with these Specifications and the site Drawings. Site restoration of disturbed areas will be completed by the Contractor with specified seeding or as otherwise approved by the Owner, whether explicitly shown on the Drawings or not.
- C. Furnish all labor, tools, equipment, material, transportation, and perform all operations necessary and incidental to proper execution and completion of all landscape installation work in accordance with the Drawings and Specifications.
- D. Observe the conditions under which Work is to be performed and notify the Owner's Representative of unsatisfactory conditions. When conditions detrimental to plant growth are encountered, such as rubble, rock fill, utility conflicts, or adverse drainage conditions, notify the Owner's Representative before planting, adding soil amendments, and other soil work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Owner.
- E. Comply with governing regulations applicable to landscape materials.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 33 00 – Submittal Procedures
- B. Section 31 05 13 – Earthwork
- C. Section 31 25 13 – Erosion Controls
- D. Section 32 93 00 - Planting

**1.3 SUBMITTALS**

- A. Provide certification that the following materials meet the specified requirements:
  - 1. Compost amendment.
  - 2. Soil fertility test results for imported topsoil with recommended soil additives (if any).
- B. Quantity Certification: Provide certification of quantities of fertilizer, topsoil, and compost delivered to the site.

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- C. Submit any change in materials, equipment, or the design in writing to the Owner's representative for review and final approval.
- D. Samples:
  - 1. Submit duplicate samples and manufacturer's guaranteed analysis of the following items and submit other materials as may be required by the Owner's representative and obtain written approval thereof before beginning installation or delivery of materials to the project site. Finished work shall match approved samples.
    - a. Soil additive conditioners (if required): 1/2 pound
    - b. Imported topsoil: 1/2 pound
    - c. Compost amendment with analysis report: 1/2 pound

**1.4 QUALIFICATIONS**

- A. Installer: The Contractor installing work covered by this Specification section must be a state licensed and bonded Landscape Contractor. Contractor must be experienced in landscape work of best-accepted trade practices and have equipment and personnel adequate to perform the work specified.

**1.5 QUALITY ASSURANCE**

- A. Comply with all governing regulations applicable to grading and soil work.
- B. Protection:
  - 1. Protect buildings, utilities, subgrade, site improvements, existing vegetation, fences, lighting, and underground irrigation systems during tiling and related soil work.
  - 2. Protection of Work: Contractor is responsible for protecting all work during site construction.
  - 3. Repair any item detailed above, not part of any demolition detail, damaged during construction to the approval of, and at no additional cost to, the Owner.
- C. Field Superintendent – provide one person who shall:
  - 1. Be present at all times during execution of work in this section;
  - 2. Be familiar with the materials and best methods for installation; and
  - 3. Direct work performed under this section.
- D. Topsoil placement and soil preparation shall not take place during periods where saturated soil or surface water is present in work areas. Soil shall be in friable (workable) condition when placed. Work shall not take place when temperature is less than 32-degrees Fahrenheit or when frozen soil exists on site.

**1.6 COORDINATION**

- A. Coordinate work with other trades.
- B. Installation of irrigation system, if used, and other utilities.
- C. It is the Landscape Contractor's responsibility to coordinate the performance of work in this Specification. Damage to existing systems, utilities, facilities, landscaping, or properties resulting from lack of coordination will be the Contractor's responsibility

**LANDSCAPE GRADING, TOPSOIL, AND SOIL PREPARATION**

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- D. Protection of subgrade: Do not allow vehicles or equipment to pump or rut subgrade, stripped areas, footing excavations, or other areas prepared for the project. Protect subgrades, fills, and excavation areas from surface waters flowing into the work areas.
- E. Coordinate the removal of grass and weeds for planting areas prior to Work in this Section.

**1.7 PRE-INSTALLATION MEETINGS**

- A. Contractor shall coordinate pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section. Minimum attendees shall be the Contractor's site superintendents, General Contractor's site superintendents, and the project's certified erosion control inspector. Pre-installation meeting may be coordinated with other work.

**1.8 EXISTING UTILITIES**

- A. The Contractor will, at their expense, have all existing utilities located at job sites. Call Utilities Notification Center, (503) 232-1987.
- B. The Contractor will protect any utilities that remain in place. Any located utilities damaged during construction will be repaired at the cost of the Contractor.
- C. Locate and identify, with visible marking, existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protection during excavation operations.
- D. If utilities not located are damaged during construction, the Contractor will comply and work with the utility company during the utility company's repairs.
- E. Do not interrupt existing utilities or service facilities occupied and used by the Owner or others.

**PART 2 - PRODUCTS****2.1 GENERAL**

- A. Native topsoil: Native (existing/stockpiled) topsoil shall be a natural friable soil and shall be reasonably free from subsoil, clay lumps, stone, or similar objects larger than 3/4-inch in greatest diameter, brush, stumps, roots, objectionable weeds or litter, growth or a hindrance to subsequent smooth grading and maintenance operations.
- B. Imported topsoil: Imported topsoil shall be naturally friable; dark brown in color; pH range of 5.5 to 7.0, a minimum of 10%-30% organic material content (may include composted yard waste consisting of 100% recycled plant waste); free draining and free of stones or debris 3/4-inch or larger in any dimension and other extraneous materials harmful to plant growth. Sodium absorption ratio maximum 4.0.
- C. Compost: Compost shall be a commercially manufactured material, medium grind, made from dead plant material such as grass clipping, green and dead dry leaves, garden and vegetable material, and ground branches of trees and shrubs. Furnish a product that is composted under controlled aerobic decomposition, with the internal temperature reaching 135-degrees Fahrenheit for 15 days, without exceeding 155-degrees Fahrenheit.

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Ensure that it contains less than 10% bacteria and less than 10% fungus, is a mature compost, and does not contain detrimental components. If it contains more than 10% bacteria and/or fungus, it is not mature compost and will not be acceptable. Certification by testing will be required.

1. Compost Analysis: Have a Compost Foodweb Analysis test performed on a sample of the compost at a soil food web lab and submit a copy of the test results to the Owner for approval. The compost must meet the criteria of this section. The test must give results in the following categories:
  - a. Active Bacterial Biomass
  - b. Total Bacterial Biomass
  - c. Active Fungal Biomass
  - d. Total Fungal Biomass
  - e. Hyphal Diameter
  - f. Protozoa Numbers
  - g. Total Nematode Numbers
2. An approved Soil Food Web Lab is:  
Soil Foodweb Inc.  
728 SW Wake Robin Ave  
Corvallis, OR 97332  
(541) 752-5066
3. Approved Material: City of Portland Leaf Compost Available through Sunderland Recycling Facility or approved equal.

D. Substitutions will only be allowed with written approval.

E. Provide fertilizer that meets the recommendations of the “Soil Fertility Test” as required by these Specifications.

**2.2 SOIL ADDITIVES**

A. Soil additives for correction of pH and trace elements deficiencies shall be in factory labeled containers and approved prior to application.

**2.3 COMMERCIAL FERTILIZER**

A. Provide fertilizer that meets the recommendations of the “Soil Fertility Test” as required in these Specifications.

**2.4 EXAMINATION**

- A. Obtain a “Soil Fertility Test” for imported topsoil for areas to receive the Work of this Section. Test results will include recommendations for soil amendments and other particulars needed to sustain plant growth.
- B. Verify prepared soil base is ready to receive the Work of this Section, including the removal of existing grass, weeds/ vegetation, gravels, etc. per these Specifications and as shown on the Drawings.
- C. Saturate soil with water to test drainage.
- D. Verify required underground utilities are available, in proper location, and ready for use.



**LANDSCAPE GRADING, TOPSOIL, AND SOIL PREPARATION****2.5 SOIL FERTILITY TEST AND RECOMMENDATION**

- A. Obtain and submit soil samples to a qualified testing laboratory for a soil fertility test and recommendation report.
- B. Imported Topsoil: Test and analyze imported topsoil to ascertain percentage of nitrogen, phosphorus, potash, soluble salt and organic matter, and pH Value. Provide recommendation for fertilizer and soil amendment application rates for specified planting as result of testing.
- C. Testing is not required for imported topsoil when recent tests are available. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.
- D. Submit the soil fertility test report(s) and laboratory recommendations for appropriate plant growth to the Owner's Representative for approval before beginning soil preparation work.
- E. The cost for testing and the fertilizer and soil additives recommended by the tests is to be borne by the Contractor and is incidental to the soil preparation work.

**PART 3 - EXECUTION****3.1 PREPARATION OF PLANTING AREAS**

- A. All areas shall be finish graded and approved by the Owner's Representative before commencement of planting. All areas shall allow for removal of gravels and undesirable/contaminated soils and placing planting soil amendments added to planting areas as specified. Sufficient topsoil (native soil, soil stockpiled and reused on site, and/or imported where necessary) shall be required for healthy plant growth in all new planting areas (refer also to Section 32 93 00 Planting and Drawings). All grades shall flow smoothly into one another and produce positive drainage. The Contractor is responsible for any adverse drainage conditions that may affect plant growth and architectural features unless the Contractor contacts the Owner's Representative immediately, indicating any possible problems.
- B. Finish grading: Finish grade all planting areas by floating and hand raking to an acceptable smooth, even grade. Remove high points and fill low pockets to eliminate the possibility of standing water. Ensure all areas have positive drainage.
  - 1. Slope all areas to prevent puddling and drain surface water toward catch basins, drains, curbs, or as shown on the Drawings.
  - 2. Bring finished grade even with adjacent curbs, walks, and level with existing grades. Remove all rocks greater than 3/4-inch diameter from the top 4-inches of soil.
  - 3. Soil in all areas shall be thoroughly settled, with a smooth surface free of humps and hollows, and shall be firm enough to resist undesirable impressions when stepped upon.
- C. Lightly irrigate soil prior to seeding. Plants shall be watered after installation.

**LANDSCAPE GRADING, TOPSOIL, AND SOIL PREPARATION**

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**3.2 CLEAN UP**

- A. Pressure washing of concrete, masonry, and asphaltic paving: Any paved area or surfaces stained or soiled from landscaping materials having been hauled, carried, or spilled over or around it shall be cleaned with a power sweeper using water under pressure. Building surfaces shall be washed with proper equipment and materials as approved by the Owner.
- B. At completion of work, remove all debris, equipment, and surplus materials from project site.
- C. Leave project site in a neat and orderly condition.
- D. Clean up and restoration will be done at Contractor's expense.

**END SECTION**

**PLANTING****SECTION 32 93 00 - PLANTING****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Furnish all labor, tools, equipment, material, transportation, and perform all operations necessary and incidental to proper execution and completion of all planting work and landscape installation work in accordance with the Drawings and Specifications.
- B. All planting work shall include lawn/seeded areas, shrubs, trees, groundcovers, and as shown in the Drawings and incidental to restoration of disturbed existing landscaping within the project area.
- C. All disturbed existing lawn/turf areas, including irrigation trenches and areas disturbed by construction activity, to receive soil preparation and specified grass seed mix for complete restoration to pre-construction condition, whether expressly shown on the Drawings or not.
- D. Comply with all governing regulations applicable to landscape materials.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 33 33 – Submittal Procedures
- B. Section 31 05 13 - Earthwork
- C. Section 32 91 19 - Landscape Grading, Topsoil, and Soil Preparation

**1.3 SUBMITTALS**

- A. Certified Confirmed Orders: Certify in writing to the Owner's Representative within thirty (30) days of the award of the contract, confirmed orders for plants and provide the quantity, location, phone number and address of the grower who has agreed to provide any plant material. Should the Contractor neglect to provide this documentation within the allocated time, contractor may forfeit any substitution benefits.
- B. Submit all substitution requests, including suggested equivalent plant material and reason for substitution request, to Owner's Representative for approval.
- C. Certificates: Certificates required by law shall accompany shipments. Upon completion of the installation, submit certificates to the Owner's Representative.
- D. Quantity Certification: Provide certification of quantities of mulch, fertilizer, herbicide, and planting accessories delivered to the site.
- E. Topsoil soil test results with recommended soil additives per Section 32 91 19
- F. Samples:
  - 1. Submit duplicate samples and manufacturer's guaranteed analysis of the following items and submit other materials as may be required by the Owner's Representative and obtain written approval thereof before beginning installation or delivery of materials to the project site. Finished work shall match approved samples.

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- a. Soil additive conditioners (if required): 1/2 pound
  - b. Bark Mulch: 1/2 pound
  - c. Imported topsoil: 1/2 pound
  - d. Compost (soil amendment): 1/2 pound
- G. Project Record Documents: Upon completion of work, submit neat and legible As-Built drawings as 'Record Drawings' indicating any changes from approved design.

**1.4 QUALIFICATIONS**

- A. Installer: The Contractor installing work covered by this Specification section must be a state licensed and bonded Landscape Contractor. Contractor must be experienced in landscape work of best-accepted trade practices and have equipment and personnel adequate to perform the work specified. Contractor must be familiar and comply with the *American Standard for Nursery Stock* (ANSI Z60.1-2014 (or current edition) published by the American Horticulture Industry Association (AmericanHort) and other governing regulations applicable to landscape materials and their installation.

**1.5 QUALITY ASSURANCE**

- A. Comply with all governing regulations applicable to landscape materials.
- B. Tree pruning, if required, shall comply with ANSI A300 *Tree, Shrub, and other Woody Plant Management – Standard Practices (Pruning)*, current edition.
- C. Field Superintendent – provide one person who shall:
- 1. Be present at all times during execution of work in this section;
  - 2. Be familiar with the materials and best methods for installation; and
  - 3. Direct work performed under this section.
- D. Government Inspection: All plants and planting material shall meet or exceed the specifications of federal, state, and local laws requiring inspection for plant disease and control.
- E. Industry Standards: Quality definitions, size tolerances, root ball sizes, and caliper-to-height ratios shall be no less than minimums specified in *American Standard for Nursery Stock* published by the American Horticulture Industry Association ANSI Z60.1-2014 (or current edition). All plant materials shall be fully rooted, well-branched, evenly formed, and typical for their species, free from disease, pests, damage or mechanical injury.
- F. Acceptance: The Owner or their Representative reserves the right to reject any or all plant material at any time until final review and acceptance. Remove rejected plants immediately from site.
- G. Certification: Produce upon request, sales receipts for all nursery stock and certificates of inspection from federal, state, and other authorities.

**1.6 GUARANTEE**

- A. All plant materials shall be guaranteed to take root and grow and thrive for a period of 365-days after final acceptance of work. Contractor shall replace at no additional expense to the Owner, any plant material that fails to thrive during that period except in cases of gross neglect and vandalism.

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**1.7 CHANGE ORDERS AND SUBSTITUTIONS**

- A. The Contractor shall provide all plants of the size, species, variety, and quality noted and specified. If unavailable, the Contractor shall notify the Owner's Representative in writing immediately and provide the names and telephone numbers of five (5) nursery suppliers that they have contacted. If substitutions should be permitted, it can be made only with the prior written approval of the Owner.

**1.8 PRE-INSTALLATION MEETINGS**

- A. Contractor shall coordinate pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section. Minimum attendees shall be the Contractor's site superintendents, General Contractor's site superintendents, and the project's certified erosion control inspector. Pre-installation meeting may be coordinated with other work.

**PART 2 - PRODUCTS****2.1 PLANT MATERIALS**

- A. Quantities: Plant materials shall be furnished in quantities required to complete work as indicated on the Drawings and shall be of species, kinds, sizes, etc. specified. If discrepancies occur, design intent of the Drawings prevails over quantities listed. Contractor shall be responsible for verifying plant and material quantities prior to bidding and construction.
- B. Nomenclature: Plant names listed on the Drawings conform to those established by custom in the nursery trade.

**2.2 QUALITY**

- A. Plants shall conform to current *American Standard for Nursery Stock*, in accordance with ANSI Z60.1 current edition, in all ways.
- B. Plants shall be symmetrical and typical for variety and species.
- C. Plants shall be nursery-grown under climatic conditions similar to those in the project area.
- D. Plants shall be sound, healthy, vigorous, and free from plant disease, insect pests, or their eggs.
- E. Container stock shall be grown in the containers in which delivered for at least eight (8) months but shall not be root bound.
- F. Root balls of "balled and burlapped" (B&B) trees shall be grown under favorable growing conditions in the nursery, having received the proper cultural treatment to develop a well-branched root system and harvested with the ball of earth in which they are growing remaining intact. Root ball size shall be of a depth and diameter to encompass enough of the root system as necessary for the full recovery of the plant and the trunk of the tree shall be centered in the root ball. Refer to *American Standard for Nursery Stock* ANSI Z60.1.
- G. Plants shall not be pruned prior to delivery, except as authorized by the Owner's Representative.

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- H. Protect plants in transit and after delivery to the project site. Plants in broken containers and plants with broken branches or injured trunks will be rejected. Remove rejected material from the site immediately.

**2.3 INSPECTION**

- A. Right of inspection for approval or rejection is reserved at the place of growth and/or the project at any time upon delivery or during works. Plants may be inspected for size, variety, condition, and defects or injury.
- B. Any additional required inspections caused by failure to assemble the required materials or rejection of plant material shall be paid for by the Contractor.
- C. Certifications or inspections shall be furnished as may be required by city, county, or state authorities.

**2.4 DIMENSIONS**

- A. Height and spread of screening materials are specified in the Drawings.
- B. Container plants shall meet minimum size and soil volume standards per *American Standard for Nursery Stock* ANSI Z60.1.

**2.5 GROUNDCOVER PLANTS**

- A. Groundcover plants, unless otherwise indicated on the Drawings, shall be rooted plants grown in containers.

**2.6 FERTILIZERS AND SOIL CONDITIONERS**

- A. Materials delivery and storage: Manufactured materials shall be delivered in original container with brand and makers name marked thereon. Materials in broken containers or showing evidence of damage will be rejected and must be immediately removed from the site. Odorous material shall not be brought to the site until they are to be used.
- B. Bark Mulch:
  - 1. Planting Beds and Mulched Areas: Well-aged medium grind or shredded dark fir or hemlock mulch as specified on the Drawings.
  - 2. Mulch shall not be placed in frequently inundated areas or in direct flow patterns to minimize migration of the mulch.
- C. Peat: A natural residue formed by decomposition of reeds, sedges or mosses from fresh water site, free from lumps, roots and stone, absorbing at least four times its dry weight of water, organic matter not less than 90% on a dry weight basis. The maximum moisture content at time of delivery 65% by weight.
- D. Rotted Sawdust: Minimum two (2) years old, color chocolate brown.
- E. Sand: Clean, coarse, ungraded, meeting the following requirements:

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<u>Sieve Size in mm</u>	<u>Tyler Standard Sieve US Series Equiv No.</u>	<u>Percent Passing by Weight</u>
4.5	4	100
2.0	10	95-100
1.0	16	85-100
0.5	30	50-70
0.25	60	0-30
0.10	140	0-10
0.07	200	0-5
0.01	270	0

- F. Manure: Shredded, well-rotted, unleached stable or cattle manure, free from weed seed and refuse, containing no chemicals or materials harmful to plant life, not less than four (4) months nor more than two (2) years old. Sawdust or shavings shall not exceed 50% content of the manure.
- G. Backfill Soil Mix for planting holes: 1 cubic yard organics; 1 cubic yard sand; 1 cubic yard sandy loam topsoil; controlled release fertilizer at manufacturers recommended application rate.
- H. Fertilizer:
1. All fertilizers and soil conditioners shall be first quality, standard brand, agricultural products.
  2. Trees and Shrubs: Controlled release fertilizer; 18-10-10-7 (N-P-K) with iron (resin coated). 18% nitrogen, 10% phosphoric acid, 10% potash, 7% sulfur or similar.
  3. Lawns: Granular, pelleted, or liquid/flowable fertilizer; composition 20% nitrogen, 20% phosphorous, 10% potassium, and 3% iron, by weight or as recommended by turfgrass sod supplier.
- I. Herbicides:
1. Initial Herbicides: Devrinol and manufactured by Stauffer Chemical Co., Romstar as manufactured by Chip Star or approved equals.
  2. Herbicides that can be used after 6-months: Simazine "Princep" as manufactured by Geigy CO., "Round-Up" as manufactured by Monsanto Chemical Co. or approved equals.

**2.7 TOPSOIL**

- A. Contractor shall remove existing gravels and contaminated and/or unsuitable soils in new planting areas within project work area.
- B. Import new topsoil or use existing topsoil stockpiled on site where available to make up required amounts for installation.
- C. Topsoil required; pH range of 5.5 to 7.0, a minimum of 10%-30% organic material content (may include composted yard waste consisting of 100% recycled plant waste), be dark brown in color, friable, free draining, free of stones or debris 3/4-inch or larger in any dimension and other extraneous materials harmful to plant growth. Sodium absorption ratio maximum 4.0.

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- D. Topsoil source: On-site topsoil or imported or manufactured soil void of roots, plants, sod, stones, clay lumps, alkali salts, and other extraneous material harmful to plant growth.

**2.8 MISCELLANEOUS MATERIALS**

- A. Tree Stakes: 2" x 2" square or 2" diameter round S4S Douglas fir pressure treated tree stakes stained with Olympic Semi-transparent #916.
- B. Tree support: 1" plastic chain or rigid guy with hose loop or approved equal.
- C. All material incidental to the completing installation of plant material part of this scope of work.

**PART 3 - EXECUTION****3.1 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Notify the Owner's Representative of delivery schedule so plant materials may be inspected upon job site delivery. Remove unacceptable products immediately from job site.
- B. Plant material damaged as a result of delivery, storage, or handling will be rejected.
- C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- D. Storage and Handling: Protect products against damage and dehydration. Store plants and materials in area dedicated for such purpose by the Owner's Representative. Do not impeded normal use of the site. Cover plant roots and root balls with soil or other accepted material upon job site delivery if not to be planted within 4-hours. Store plant material in light shade and protect against harmful weather until planted. Maintain plant materials not to be planted within 4-hours.
- E. Turfgrass sod may be used in place of seeding depending on weather conditions with approval by the Owner's Representative. Sod, if used, shall be harvested, delivered, and installed/transplanted within a period of 24-hours, unless a suitable preservation method is approved prior to delivery. Turfgrass sod not transplanted within this period, or preserved by approved methods, shall be inspected and approved by the Owner's Representative prior to its installation.
- F. Bulk Materials:
  - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
  - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
  - 3. Accompany each delivery of bulk materials with appropriate certificates.



**PLANTING****3.2 EXAMINATION**

- A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.
  - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, rock fill, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
  - 2. When conditions detrimental to plant growth are encountered, notify the Owner's Representative before planting or adding soil amendments. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to the Owner.
  - 3. If contamination by foreign or deleterious material or liquid is present in the soil within a planting area, remove the soil and contaminations as directed by the Owner's Representative and replace with new planting soil. Contaminated soil shall be disposed of in accordance with applicable federal, state, and local jurisdictional requirements.

**3.3 ENVIRONMENTAL REQUIREMENTS**

- A. Do not install plant material when ambient temperatures may drop below 35-degrees F or rise above 90-degrees F.
- B. Do not install plant material when wind velocity exceeds 30-mph.
- C. Do not install plant material in adverse drainage conditions.
- D. Turfgrass sod, if used, shall not be installed if sod is dormant or if ground is frozen or muddy.

**3.4 COORDINATION**

- A. Install plants after, and coordinate with, installation of any underground irrigation system piping and sprinkler heads, pavement, retaining walls, fencing materials, earthwork, and other site work.

**3.5 PROTECTION**

- A. Verify location of underground utilities and facilities prior to doing work.
- B. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations. Repair and make good any damage to services lines or improvements caused by planting operations at no additional cost to the Owner.
  - 1. Protect grade stakes set by others until directed to remove them.
  - 2. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing runoff or airborne dust to adjacent properties, and walkways.
  - 3. If encountered, repair and/or replace existing irrigation components necessary to maintain full operation of the irrigation system to areas inside and outside of the project work area where it is affected by work completed as part of this scope. Coordinate with the Owner's Representative to test any existing irrigation system after repair work to ensure it is completed to the satisfaction of the Owner.

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- C. Protect all planted areas and plants against trespassing and damage at all times until date of final acceptance. If any plants are damaged, treat or replace as directed by the Owner's Representative, without additional cost to the Owner.
- D. Contractor shall make, at the Contractor's expense, whatever arrangements are necessary to ensure an adequate supply of water to meet the needs of this contract. If an irrigation system is used, Contractor shall also furnish necessary hose, equipment, attachments, and accessories for the adequate irrigation of planting areas during planting and until irrigation system is fully operational, as may be required to protect plants in good condition. All costs of water incurred during the contract period shall be borne by the Contractor unless other arrangements are made with the Owner or utility purveyor. Water must be clean, fresh, and free of substances or matter capable of inhibiting vigorous plant growth.

**3.6 PREPARATION**

- A. Do not install plant materials until all construction work has been completed and any irrigation systems have been installed and tested.
- B. Grades: Meet the desired elevations next to all paving and curbs.
- C. Soil shall be at an optimum moisture content for planting and be in friable (workable) condition. Soil shall not be worked when moisture content is so great that excessive compaction will occur, nor when it is so dry that dust will form in the air or that clots will not break readily. Water shall be applied, if necessary, to bring soil to an optimum moisture content for tilling and planting.
- D. Soil loosening: Subgrade in all new planting areas shall be cultivated to 6" depth. Do not disturb root zones of existing trees to remain.
- E. After topsoil has been completed and the soil water-settled, high and low spots regraded, add soil amendments where required.
- F. Turf Area Preparation:
  - 1. Reduce elevation of planting soil bed as required to allow for soil thickness of sod (if used) or seed application (1/2" below adjacent pavement or as shown in the Drawings).
  - 2. Moisten prepared planting bed area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
  - 3. Before laying sod or applying seed, obtain Owner's Representative acceptance of finish grading. Restore planting areas if eroded or otherwise disturbed after finish grading.
- G. All areas to be planted shall be cleaned of all weeds and debris prior to any soil preparation or grading work. Noxious weeds and grasses shall be removed by the roots wherever they are found at any stage of the work and disposed of offsite. Initially apply Devrinol or equal as necessary to assure weed eradication and control in all new planting areas in accordance with manufacturer's printed instructions.
- H. Tree Planting Holes:
  - 1. Locate tree planting holes per Drawings, bringing any conflict with underground utilities and facilities to the attention of the Owner's Representative. Locations for

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holes shall be staked on the site and the Owner's Representative's approval thereof obtained prior to excavating planting holes.

2. Excavate holes to the sizes and depths indicated on the Drawings or as necessary to maintain soil level of plants as grown in the Nursery. Top of finished soil level shall not cover root crown/trunk flare of trees.
3. Clean topsoil may be used in backfill.
4. Scarify the sides and bottom of the planting holes.

**3.7 INSTALLATION OF TOPSOIL**

- A. Areas to receive topsoil: all planting beds and lawn areas as described in the Drawings. New planting areas shall be excavated to a depth to reach free-draining subsoil free of contaminants, deleterious material, or other material harmful to plant growth.
- B. Add soil conditioners as recommended by soil test to meet minimum soil requirements as indicated on the Drawings and Specifications.
- C. Installation: In all new planting bed areas, loosen prepared subgrade 2" and place topsoil the minimum depth indicated on the Drawings. Spread in not more than 6" lifts, making sure soil is thoroughly integrated. Add 2" compost amendment and till to a depth of 8". Bring to a smooth even grade. Soil shall be thoroughly water-settled and high and low areas regraded to provide positive drainage and as indicated on the Drawings.

**3.8 SOIL CONDITIONS**

- A. Finished grading: When weeding, soil preparation, and soil conditioning have been completed and soil has been thoroughly water-settled, all planting areas shall be smooth graded, ready for placement of plant materials.
- B. Finished Grades shown on the Drawings: Slope uniformly between given spot elevations.
  1. Mulch areas: Finished grades shall be 2" below top of adjacent pavement, curbs or walls unless otherwise indicated on the Drawings to allow for mulch application.
  2. Lawn areas: Finished grades shall be 1/2" below top of adjacent pavement curbs or walls unless otherwise indicated on the Drawings.

**3.9 WEED CONTROL**

- A. Apply initial pre-emergence herbicide to all mulch areas in accordance with the manufacturer's recommended rates.

**3.10 MULCHING**

- A. Install a 3" deep mulch layer over all planting beds and mulch areas, except where lawn areas occur or in frequently inundated areas or in direct flow patterns to minimize migration of the mulch.

**3.11 TREE STAKING**

- A. Set stakes plumb and in such a way as to limit obstruction to vehicular or pedestrian movement. Securely tie trunks to stakes as detailed or as recommended by tie manufacturer.

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**3.12 GENERAL CLEAN UP**

- A. Construction site shall be kept free of debris, excess dirt, etc. during construction to the maximum extent practicable.
- B. Remove all cans, surplus materials, and other construction debris from site. Neatly dress and finish all planting areas. Flush walks, paved areas, and the like clean to the satisfaction of the Owner's representative.
- C. Rinse foliage of all plant materials within the construction area as often as necessary to keep the foliage free of dust from work of this contract. Remove tags and nursery labels from plant material.

**END SECTION**

**SECTION 33 05 13 - MANHOLES AND STRUCTURES**

**PART 1 GENERAL**

**3.1 SUMMARY**

- A. Section Includes:
1. Modular precast concrete manhole and structures with tongue-and-groove joints, frame, covers, anchorage, and accessories.
  2. Bedding and cover materials.
  3. Raising manhole frames and covers.
  4. Replacing manhole frames and covers.
- B. Related Sections:
1. Section 31 05 13 - Earthwork
  2. Section 32 12 16 - Asphalt Paving.
  3. Section 33 31 00 – Sanitary Utility Sewerage Piping
  4. Section 33 41 00 - Storm Utility Drainage Piping.

**3.2 REFERENCES**

- A. American Concrete Institute:
1. ACI 318 - Building Code Requirements for Structural Concrete.
- B. ASTM International:
1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
  2. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
  3. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
  4. ASTM C923 - Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes and Laterals.
  5. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
  6. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
  7. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

**3.3 DESIGN REQUIREMENTS**

- A. Equivalent strength: Based on structural design of reinforced concrete as outlined in ACI 318.
- B. Design of Lifting Devices for Precast Components: In accordance with ASTM C913.
- C. Design of Joints for Precast Components: In accordance with ASTM C913; maximum leakage of 0.025 gallons per hour per foot of joint at 3 feet of head.

**3.4 SUBMITTALS**

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

**MANHOLES AND STRUCTURES**

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- B. Shop Drawings: Indicate manhole and structure locations, rim elevations, piping sizes, angles of entry/exit, and invert elevations of penetrations.
- C. Product Data: Submit cover and frame construction, features, configuration, dimensions.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

**3.5 CLOSEOUT SUBMITTALS**

- A. Section 01 78 00 – Closeout Submittals: Requirements for submittals.
- B. Project Record Documents: Record actual grade adjustment elevation of manhole.
- C. Provide manufacturer warranty information.

**3.6 QUALITY ASSURANCE**

- A. **All Work in the public rights of way or easements dedicated to the public shall be in accordance with the local Governing Authority having Jurisdiction**
- B. Maintain one copy of each document on site.

**3.7 DELIVERY, STORAGE AND HANDLING**

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in undamaged, unopened container, bearing manufacturer's original labels. Inspect for damage.
- C. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast manholes and structures.
- D. Store precast concrete manholes and structures to prevent damage to Owner's property or other public or private property. Repair property damaged from materials storage.
- E. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Drawings to indicate its intended use.

**3.8 FIELD MEASUREMENTS**

- A. Verify field measurements prior to fabrication.

**PART 2 PRODUCTS****2.1 MANHOLES AND STRUCTURES**

- A. Manhole Sections: Reinforced precast concrete manhole sections and integral steps in accordance with ASTM C478, with gaskets in accordance with ASTM C923. Minimum wall thickness four inches. Provide eccentric cones or flat top sections where necessary. All materials to be H20 rated.

- B. Mortar: Standard pre-mix mortar conforming to ASTM C387, Type N.

## **2.2 FRAMES AND COVERS**

- A. Product Description: ASTM A48/A48M, Class 30B Cast iron construction, machined flat bearing surface, removable or lockable or boltable lid, of the size and shape detailed on the drawings with load rating of H20.

## **2.3 COMPONENTS**

- A. Manhole and Structure Steps: As indicated on Drawings.
- B. Base Pad: As indicated on Drawings.
- C. Manhole Steps: Copolymer polypropylene encapsulated steel bars.

## **2.4 CONFIGURATION**

- A. Shaft Construction: Concentric with eccentric cone top section; lipped male/female joints; sleeved to receive pipe.
- B. Shape: Cylindrical
- C. Clear Inside Dimensions: As indicated on Drawings.
- D. Design Depth: As indicated on Drawings.
- E. Clear Cover Opening: As indicated on Drawings.
- F. Pipe and Conduit Entry: Furnish openings as indicated on Drawings.
- G. Steps: As indicated on Drawings. Positioned so as not to interfere with pipe penetrations

## **2.5 BEDDING AND COVER MATERIALS**

- A. Bedding: Fill Type as specified in Section 31 05 13.
- B. Cover: Fill Type, as specified in Section 31 05 13.
- C. Soil Backfill from Above Pipe to Finish Grade: Soil Type as specified in Section 31 05 13

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Contractor shall coordinate verification of existing conditions before starting work.
- B. Verify items provided by other sections of Work are properly sized and located.
- C. Verify built-in items are in proper location, and ready for roughing into Work.
- D. Verify correct size of manhole and structure excavation.

- E. Verify and locate manholes requiring grade adjustment.

### **3.2 PREPARATION**

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.
- B. Do not install structures where site conditions induce loads exceeding structural capacity of structures.
- C. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.

### **3.3 INSTALLATION**

- A. Excavation and Backfill:
  - 1. Excavate for manholes [and structures] in accordance with Section 31 05 13 in location and to depth shown. Provide clearance around sidewalls of structure for construction operations.
  - 2. When groundwater is encountered, prevent accumulation of water in excavations. Place manholes and structures in dry trench.
  - 3. Where possibility exists of watertight structure becoming buoyant in flooded excavation, anchor structure to avoid flotation.
- B. Place base pad, smooth top surface level.
- C. Install manholes and structures plumb and level, supported at proper grade and alignment on crushed stone bedding as shown on Drawings.
- D. Backfill excavations for manholes and structures in accordance with Section 31 05 13.
- E. Cut and fit for pipe.
- F. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour to form continuous drainage channel as indicated on Drawings.
- G. Set cover frames and covers level without tipping, to correct elevations.
- H. Coordinate with other sections of Work to provide correct size, shape, and location.

### **3.4 PRECAST CONCRETE MANHOLE AND STRUCTURE INSTALLATION**

- A. Lift precast components at lifting points designated by manufacturer.
- B. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and structure remains clean.
- C. Set precast structures bearing firmly and fully on crushed stone bedding, compacted in accordance with provisions of Section 31 05 13 or on other support system shown on Drawings.
- D. Assemble multi-section structures by lowering each section into excavation. Lower, set level, and firmly position base section before placing additional sections.
- E. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.
- F. Joint sealing materials may be installed on site or at manufacturer's plant.
- G. Verify manholes and structures installed satisfy required alignment and grade.
- H. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe. Fill annular space with mortar.
- I. Cut pipe to finish flush with interior of structure.
- J. Shape inverts through manhole and structures as shown on Drawings.



**3.5 FRAME AND COVER INSTALLATION**

- A. Set frames without tipping using non-shrink and grout. Set frame and cover 2 inches above finished grade for manholes and structures with covers located within unpaved areas to allow area to be graded away from cover beginning 1 inch below top surface of frame. Set frames flush with finished grades when located in pavement or other hard surface areas.

**3.6 RAISING MANHOLE FRAMES AND COVERS**

- A. Locate and raise manholes to grade as indicated on Drawings.
- B. Seal joints between manhole top and frame with sealant.
- C. Reinstall removed manhole frame and cover.

**3.7 RESTORATION**

- A. Restore bituminous paving areas in accordance with Section 32 12 16. Restore grassed areas in accordance with Section 32 93 00.

**3.8 FIELD QUALITY CONTROL**

- A. Section 01 40 00 - Quality Requirements, 01 78 00 – Closeout Submittals: Field inspecting, testing, adjusting, and balancing.
- B. Vertical Adjustment of Existing Manholes and Structures:
  - 1. Where required, adjust top elevation of existing manholes and structures to finished grades shown on Drawings.
  - 2. Reset existing frames, grates and covers, carefully removed, cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.

**END OF SECTION**

**SECTION 33 11 16 - SITE WATER UTILITY DISTRIBUTION PIPING**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. Pipe and fittings for site water line including domestic water line and fire water line.
  2. Pipe and fittings for domestic water service connections to buildings.
  3. Valves & Valve Boxes.
  4. Fire Hydrants.
  5. Backflow preventers.
  6. Underground pipe markers.
  7. Precast concrete vault.
  8. Bedding and cover materials.
  9. Disinfection of potable water distribution system; and testing and reporting results.
- B. Related Sections:
1. Section 31 05 13 – Earthwork.
  2. Section 33 05 13 - Manholes and Structures.
  3. Section 32 84 00 – Irrigation System.

**1.2 REFERENCES**

- A. American Society of Mechanical Engineers:
1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
  2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- B. American Society of Sanitary Engineering:
1. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent.
  2. ASSE 1013 - Reduced Pressure Principle Backflow Preventers.
- C. ASTM International:
1. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
  2. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures.
  3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>).
  4. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
  5. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
  6. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

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7. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
  8. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
  9. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
  10. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
  11. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- D. American Water Works Association:
1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
  2. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  3. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
  4. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
  5. AWWA C502 - Dry-Barrel Fire Hydrants.
  6. AWWA C504 - Rubber-Sealed Butterfly Valves.
  7. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in. (50 mm) Through 24 in. (600 mm) NPS.
  8. AWWA C509 - Resilient-Seated Gate Valves for Water-Supply Service.
  9. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
  10. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
  11. AWWA C651 - Disinfecting Water Mains.
  12. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
  13. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.
  14. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
- E. Underwriters Laboratories Inc.:
1. UL 246 - Hydrants for Fire - Protection Service.
- F. National Fire Protection Association:
1. NFPA 281 - Recommended Practice for Fire Flow Testing and Marking of Hydrants

**1.3 SUBMITTALS**

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

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- B. Product Data: Submit data on pipe materials, pipe fittings, valves and accessories. Submit procedures, proposed chemicals, and treatment levels for disinfection for review.
- C. Test Reports: Indicate results comparative to specified requirements.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- E. Certificate: Certify cleanliness of water distribution system meets or exceeds Governing Authority having Jurisdiction.

**1.4 CLOSEOUT SUBMITTALS**

- A. Section 01 78 00 – Closeout Submittals: Requirements for submittals.
- B. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- D. Disinfection Report:
  - 1. Type and form of disinfectant used.
  - 2. Date and time of disinfectant injection start and time of completion.
  - 3. Test locations.
  - 4. Name of person collecting samples.
  - 5. Initial and 24-hour disinfectant residuals in treated water in ppm for each outlet tested.
  - 6. Date and time of flushing start and completion.
  - 7. Disinfectant residual after flushing in ppm for each outlet tested.
- E. Bacteriological Report:
  - 1. Date issued, project name, and testing laboratory name, address, and telephone number.
  - 2. Time and date of water sample collection.
  - 3. Name of person collecting samples.
  - 4. Test locations.
  - 5. Initial and 24-hour disinfectant residuals in ppm for each outlet tested.
  - 6. Coliform bacteria test results for each outlet tested.
  - 7. Certify water conforms, or fails to conform, to bacterial standards of Governing Authority having Jurisdiction.
- F. Water Quality Certificate: Certify water conforms to quality standards of Governing Authority having Jurisdiction, suitable for human consumption.
- G. Provide manufacturer warranty information.

## **1.5 QUALITY ASSURANCE**

- A. **All Work in the public rights of way or easements dedicated to the public shall be in accordance with the local Governing Authority having Jurisdiction.**
- B. Perform Work in accordance with AWWA C651, Governing Authority having Jurisdiction, the Oregon Plumbing Specialty Code and Uniform Fire Code.
- C. Maintain one copy of each document on site.
- D. Valves: Manufacturer's name and pressure rating marked on valve body.

## **1.6 QUALIFICATIONS**

- A. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this section with minimum three years documented experience.
- B. Testing Firm: Company specializing in testing potable water systems, certified approved by State of Oregon.
- C. Submit bacteriologist's signature and authority associated with testing.

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

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver and store valves in shipping containers with labeling in place.

# **PART 2 PRODUCTS**

## **2.1 GENERAL**

- A. All water pipe in the public right of way or easement prior to backflow device, shall be in accordance with the Governing Authority having Jurisdiction.
- B. All water pipe on private property after the backflow device, shall be in accordance with the Oregon Plumbing Specialty Code and the Uniform Fire Code.

## **2.2 WATER PIPING**

- A. Ductile Iron Pipe: AWWA C151, C104 CL 51
  - 1. Fittings: Ductile iron, CL 51.
  - 2. Joints: AWWA C111, rubber gasket with rods.
- B. PVC Pipe: (Private domestic service) ASTM D1785, Schedule 40, Schedule 80:
  - 1. Fittings: ASTM D2466, PVC.
  - 2. Joints: ASTM D2855, solvent weld.

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- C. PVC Pipe: (Private lines 4" and larger) AWWA C900 DR 18:
  - 1. Fittings: AWWA C111, cast iron.
  - 2. Joints: ASTM D3139 compression gasket ring.
- D. Restrained Joint Pipe: Restrained joint pipe and fittings, use a mechanical joint with a MEGALUG follower gland as manufactured by EBAA Iron Corporation, or equal. Other acceptable restrained joints are "Loc-Tyte" joint as manufactured by the Pacific States Cast Iron Pipe Company and the United States and Foundry Company, the "Locked Fastite" joint as manufactured by the American Cast Iron Company, the "TR Flex" joint as manufactured by the United States Pipe and Foundry Company, the "Snap-Lok" joint as manufactured by the Griffin Pipe Products Co., the "Field-Lok", joint as manufactured by the United States Pipe and Foundry Company. Set screw-type retainer gland and joint harness systems will not be allowed.

**2.3 GATE VALVES**

- A. 2-1/2 inches and Smaller: Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, extension box and valve key.
- B. 3 inches and Larger: AWWA C500, Iron body, bronze trim, non-rising stem with square nut, single wedge, flanged or mechanical joint ends, control rod, extension box and valve key.

**2.4 SWING CHECK VALVES**

- A. 2 inches to 24 inches: AWWA C508, iron body, bronze trim, 45-degree swing disc, renewable disc and seat, flanged ends.

**2.5 BUTTERFLY VALVES**

- A. 2 inches to 24 inches: AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, infinite position lever handle.

**2.6 HYDRANT**

- A. Hydrant: In accordance with local fire department and/or Governing Authority having Jurisdiction requirements.
  - 1. Meet AWWA C502 specifications.
  - 2. Have 6-inch flanged joint inlet.
  - 3. Have one 4½-inch pumper connection and two 2½-inch connections with ANSI B26 standard threads.
  - 4. Have "O" ring seals on operating stem.
  - 5. Operating stem nut dimensions conforming to the Governing Authority having Jurisdiction and/or Tualatin Valley Fire & Rescue.
  - 6. Have break-off joint located approximately 2-inches above ground surface.
  - 7. Have drain hole in base.
  - 8. Open counterclockwise

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- B. Hydrant Extensions: Fabricate in multiples of 6 inches with rod and coupling to increase barrel length.
- C. Hose and Streamer Connection: Match sizes and type of thread with local fire department two hose nozzles one pumper nozzle.
- D. Finish: Primer and two coats of enamel color in accordance with Governing Authority having Jurisdiction and/or fire department requirements.

**2.7 WATER METERS**

- A. Coordinate with Governing Authority having Jurisdiction.

**2.8 BACKFLOW PREVENTERS**

- A. Double Check Valves (DCV): Comply with ASSE 1015; Bronze body with corrosion resistant internal parts and stainless-steel springs; two independently operating check valves with intermediate atmospheric vent, Watts, Conbraco, Febco, or approved equal:
- B. Furnish materials in accordance with Oregon Plumbing Specialty Code.

**2.9 UNDERGROUND PIPE MARKERS**

- A. Trace Wire: Magnetic detectable conductor, clear, brightly colored, plastic covering, imprinted with "Water Service" in large letters Brimar or approved.

**2.10 PRECAST CONCRETE VAULT**

- A. Utility Vault or approved equal.
- B. Furnish materials in accordance with Governing Authority having Jurisdiction standards.
- C. Product Description: Precast vault designed in accordance with ASTM C858, comprising modular, interlocking sections complete with accessories.
- D. Shape & size: As indicated on Drawings.
- E. Frames and Covers: As indicated on Drawings
- F. Pipe Entry Locations: As indicated on Drawings.
- G. Steps: As indicated on Drawings.

**2.11 BEDDING AND COVER MATERIALS**

- A. Bedding: Fill Type as specified in Section 31 05 13
- B. Cover: Fill Type as specified in Section 31 05 13

## **2.12 ACCESSORIES**

- A. Valve Boxes: 2 piece sliding cast iron, cover to be cast with “W” in lid.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Contractor shall coordinate verification of existing conditions before starting work.
- B. Verify building service connection and municipal utility water main size, location, and invert are as indicated on Drawings.
- C. Verify piping system has been cleaned, inspected, and pressure tested.
- D. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

### **3.2 PREPARATION**

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

### **3.3 BEDDING**

- A. Excavate pipe trench in accordance with Section 31 05 13 for Work of this Section.
- B. Form and place concrete for pipe thrust restraints at change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide sq ft area thrust restraint bearing on subsoil as indicated on the drawings.
- C. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 8 inches compacted depth; compact to in accordance with Section 31 05 13.
- D. Backfill around sides and to top of pipe in accordance with Section 31 05 13.
- E. Maintain optimum moisture content of fill material to attain required compaction density.

### **3.4 INSTALLATION - PIPE**

- A. Maintain separation of water main from sewer in accordance with Governing Authority having Jurisdiction.
- B. Group piping with other site piping work whenever practical.



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- C. Install pipe to indicated elevation to within tolerance of 5/8 inches.
- D. Install ductile iron piping and fittings to AWWA C600.
- E. Route pipe in straight line.
- F. Install pipe to allow for expansion and contraction without stressing pipe or joints. Excavate for pipe bells to provide uniform support along its full length.
- G. Form and place concrete for thrust restraints at each elbow or change of direction of pipe main.
- H. Establish elevations of buried piping with not less than 3 ft of cover or as shown on drawings.
- I. Install access fittings to permit disinfection of water system.
- J. Install trace wire continuous over top of pipe buried above pipe line; coordinate with Section 31 05 13.
- K. Backfill trench in accordance with Section 31 05 13.

**3.5 INSTALLATION - VALVES AND HYDRANTS**

- A. Set valves on solid bearing soil.
- B. Center and plumb valve box over valve. Set box cover flush with finished grade.
- C. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.
- D. Set hydrants to grade, with nozzles above ground as shown on drawings.
- E. Locate control valve away from hydrant as shown on drawings.

**3.6 INSTALLATION - METERS**

- A. Coordinate with Governing Authority having Jurisdiction.

**3.7 SERVICE CONNECTIONS**

- A. Install water service to 5 feet of building. Coordinate with building plumbing and fire sprinkler contractors.

**3.8 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM**

- A. Provide and attach required equipment to perform the Work of this section.
- B. Inject treatment disinfectant into piping system.

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- C. Maintain disinfectant in system for time period as required.
- D. Flush, circulate, and clean until required cleanliness is achieved, use municipal domestic water.
- E. Replace permanent system devices removed for disinfection.

**3.9 FIELD QUALITY CONTROL**

- A. Section 01450 - Quality Requirements and 01700 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Perform pressure test on domestic site water distribution system in accordance with AWWA C600 and Governing Authority having Jurisdiction

OR

- C. Perform pressure test on domestic site water distribution system in accordance with Oregon Plumbing Specialty Code, AWWA 600, AWWA 605 and/or the Governing Authority having Jurisdiction whichever is more stringent. Repair leaks and retest. In general pressure testing shall be as follows:
  - 1. After completion of pipeline installation, including backfill, but prior to final connection to existing system, conduct, in presence of Architect/Engineer, concurrent hydrostatic pressure and leakage tests in accordance with AWWA C600.
  - 2. Provide equipment required to perform leakage and hydrostatic pressure tests.
  - 3. Test Pressure: Not less than 200 psi or 50 psi in excess of maximum static pressure, whichever is greater.
  - 4. Conduct hydrostatic test for at least two-hour duration.
  - 5. No pipeline installation will be approved when pressure varies by more than 5 psi at completion of hydrostatic pressure test.
  - 6. Before applying test pressure, completely expel air from section of piping under test. Provide corporation cocks so air can be expelled as pipeline is filled with water. After air has been expelled, close corporation cocks and apply test pressure. At conclusion of tests, remove corporation cocks and plug resulting piping openings.
  - 7. Slowly bring piping to test pressure and allow system to stabilize prior to conducting leakage test. Do not open or close valves at differential pressures above rated pressure.
  - 8. Examine exposed piping, fittings, valves, hydrants, and joints carefully during hydrostatic pressure test. Repair or replace damage or defective pipe, fittings, valves, hydrants, or joints discovered, following pressure test.
  - 9. No pipeline installation will be approved when leakage is greater than that determined by the following formula:

$L = (SD\sqrt{P})/133,200$
L = allowable, in gallons per hour
S = length of pipe tested, in inches

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D = nominal diameter of pipe, in inches
p = average test pressure during leakage test, in pounds per square inch (gauge)

10. When leakage exceeds specified acceptable rate, locate source and make repairs. Repeat test until specified leakage requirements are met.
- D. Compaction Testing for Bedding: In accordance with ASTM D1557, ASTM D2922, and ASTM D3017.
- E. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- F. Disinfection, Flushing, and Sampling:
  1. Disinfect pipeline installation in accordance with AWWA C651. Use of liquid chlorine is not permitted
  2. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use.
  3. Legally dispose of chlorinated water. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.
  4. After final flushing and before pipeline is connected to existing system, or placed in service, employ an approved independent testing laboratory to sample, test and certify water quality suitable for human consumption.

**END OF SECTION**

**SECTION 33 31 00 - SANITARY UTILITY SEWERAGE PIPING**

**PART 1 GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Sanitary sewage pipe.
2. Underground pipe markers.
3. Manholes and cleanouts.
4. Bedding and cover materials.
5. Pipeline flushing and cleaning.
6. TV inspection of sewer pipelines.
7. Audio-video taping of pipeline interior.

**B. Related Sections:**

1. Section 31 05 13 - Soils for Earthwork: Soils for backfill in trenches. Aggregates for Earthwork: Aggregate for backfill in trenches. Excavation: Product and execution requirements for excavation and backfill required by this section. Excavation: Product and execution requirements for excavation and backfill required by this section. Trenching: Execution requirements for trenching required by this section. Fill: Requirements for backfill to be placed by this section.

**1.2 REFERENCES**

**A. ASTM International:**

1. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe.
2. ASTM D1157 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> ).
3. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
4. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
5. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
6. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
8. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
9. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

### **1.3 DEFINITIONS**

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

### **1.4 SUBMITTALS**

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data indicating pipe material used and pipe accessories
- C. Where required by the Administrative Authority having jurisdiction, submit completed tape cassettes, cd, dvd or digital files, identified by number, project name, street name, right-of-way property name, and manhole numbers. Video files become the property of Owner.
- D. Submit cleaning and television inspection logs for each section of sewer line to be rehabilitated and three copies of color videotapes, cd, dvd or digital files for work performed. Include the following as minimum information: stationing and location of lateral services, wyes or tees, clock references, pipe joints, infiltration/inflow defects, cracks, leaks, offset joints, and other information required to assess condition of sewer.
- E. Submit a specific detailed description of proposed bypass pumping system to include written description of plan and addressing quantity, capacity, and location of pumping equipment. Submit spill plan to address any spills that might occur.
- F. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

### **1.5 CLOSEOUT SUBMITTALS**

- A. Section 01 78 00 – Closeout Submittals: Requirements for submittals.
- B. Project Record Documents: Record location of pipe runs, bends, connections, manholes, cleanouts, and invert elevations.
- C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- D. Provide manufacturer warranty information.

### **1.6 QUALITY ASSURANCE**

- A. **All Work in the public rights of way or easements dedicated to the public shall be in accordance with the local Governing Authority having Jurisdiction.**

**SANITARY UTILITY SEWERAGE PIPING**

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- B. All Work outside public rights of way shall conform to Oregon Plumbing Specialty Code for materials and installation of the Work of this section.
- C. Use cameras with video output capable of producing minimum of 600 lines of horizontal resolution at center; optimum imagery with minimum illumination; and meet requirements of EIA Standard Video Signal.
- D. Maintain one copy of each document on site.

**1.7 FIELD MEASUREMENTS**

- A. Verify field measurements and elevations are as indicated.

**1.8 COORDINATION**

- A. Contractor shall coordinate project conditions.
- B. Coordinate work with Owner and Administrative Authority having jurisdiction and other contractor's work.
- C. Coordinate the Work with termination of sanitary sewer connection outside building, connection to municipal sewer utility service and trenching.

**PART 2 PRODUCTS****2.1 SANITARY SEWAGE PIPE**

- A. Ductile Iron Pipe: ASTM A746, Extra Heavy Service type, inside nominal diameter as indicated on the drawings, bell and spigot ends.
  - 1. Fittings: Ductile iron.
  - 2. Joints: AWWA C111, rubber gasket joint devices.
- B. Plastic Pipe: ASTM D3034, Type PSM, Poly (Vinyl Chloride) (PVC) material; inside nominal diameter as indicated on the drawings, bell and spigot style rubber ring sealed gasket joint.
  - 1. Fittings: PVC.
  - 2. Joints: ASTM F477, elastomeric gaskets.

**2.2 ACCESSORIES:**

- A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, clean-outs, reducers, traps and other configurations required.
- B. Trace Wire: Magnetic detectable conductor, clear, brightly colored plastic covering, imprinted with "Sewer Service" in large letters. Brimar or approved equal.

### **2.3 MANHOLES**

- A. Shaft Construction: Reinforced precast concrete sections as shown in the drawings
- B. Manhole Lid and Frame:
  - 1. Cast iron construction, as shown on the drawings.
- C. Construction and Concentric/Eccentric Cone Top Section: Reinforced precast concrete sections, lipped male/female dry joints, ladder rungs into shaft sections at 12 inches; nominal manhole diameter of 48 inches or as shown on the drawings.
- D. Base Pad: Cast-In-Place concrete for connection to existing sewer mains, precast sleeved to receive sewer pipe sections for connection to new sewer mains.

### **2.4 CLEANOUTS**

- A. Cleanout Lid and Frame: Cast iron construction, as indicated on drawings.
  - 1. Lid Design: As indicated.
- B. Shaft Construction: Of the same material as the pipe, nominal shaft diameter of eight inches.
- C. Concrete: 3000 psi concrete.

### **2.5 BEDDING AND COVER MATERIALS**

- A. Bedding: Fill Type as specified in Section 31 05 13.
- B. Cover: Fill Type as specified in Section 31 05 13.
- C. Soil Backfill from Above Pipe to Finish Grade: as specified in Section 31 05 13.

### **2.6 SEWER VIDEO INSPECTION**

- A. VHS, DVD or acceptable digital format.
- B. Audio track containing simultaneously recorded narrative commentary and evaluations of electrographer describing in detail condition of pipeline interior.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Contractor shall coordinate verification of existing conditions before starting work.
- B. Verify trench cut excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

### **3.2 PREPARATION**

- A. Correct over excavation with fine or coarse aggregate.
- B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.
- C. Flush and clean pipeline interiors to remove sludge, dirt, sand, stone, grease, and other materials from pipe to ensure clear view of interior conditions. Do not flush materials into sewer system.
- D. Furnish materials, labor, equipment, power, maintenance, to implement a temporary by-pass pumping system around work area for time required to complete connections to or reroutes of existing sewer mains.

### **3.3 BEDDING**

- A. Excavate pipe trench in accordance with Section 31 05 13.
- B. Place bedding material at trench bottom, level materials in continuous layer not exceeding that shown in the drawings.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

### **3.4 INSTALLATION - PIPE**

- A. Install pipe, fittings, and accessories in accordance with ASTM D2321 Seal joints water-tight.
- B. Lay pipe to slope gradients noted on drawings with maximum variation from indicated slope of 1/8 inch in 10 feet.
- C. Install bedding at sides and over top of pipe to minimum compacted thickness of 12 inches.
- D. Refer to Section 31 05 13 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.
- E. Refer to Section 33 05 13 for manhole requirements.
- F. Install trace wire and colored marker tape continuous over top of pipe; coordinate with Section 31 05 13.
- G. Install site sanitary sewage system piping to 5 feet of building. Connect to building sanitary waste system and municipal sewer system.

### **3.5 INSTALLATION – CLEANOUTS**

- A. Form and place cast-in-place concrete pad with provision for sanitary sewer pipe ends.



- B. Establish elevations and inverts for inlets and outlets as indicated.
- C. Mount lid and frame level to elevation indicated.

### **3.6 FIELD QUALITY CONTROL**

- A. Section 01 40 00 - Quality Requirements, 01 78 00 – Closeout Submittals: Field inspecting, testing, adjusting, and balancing.
- B. Perform test on site sanitary sewage system in accordance with Oregon Plumbing Specialty Code and Oregon Health Division.
- C. Request inspection as required by Governing Authority having Jurisdiction.
- D. Compaction Testing: In accordance with ASTM D1557, ASTM D2922, ASTM D3017.
- E. When tests indicate Work does not meet specified requirements, remove work, replace and retest.
- F. Frequency of Compaction Tests per section 31 05 13.
- G. When required by Governing Authority having jurisdiction, closed-circuit TV Camera System:
  - 1. Utilize cameras specifically designed and constructed for closed-circuit sewer line inspection. Utilize camera equipment with pan and tilt capability to view each lateral connection at multiple angles.
  - 2. Utilize camera capable of moving both upstream and downstream; minimum 1,000 feet horizontal distance with one setup, direct reading cable position meter.
- H. Pipeline Inspection:
  - 1. Audio-video tape sections of sewer pipeline between manholes designated.
  - 2. Identify and record locations of flat grades, dips, deflected joints, open joints, broken pipe, protrusions into pipeline, and points of infiltration.
  - 3. Locate and record service connections.
  - 4. Record locations of pipeline defects and connection horizontal distance, in feet, and direction from manholes.
  - 5. Video with pipe section plugged as to view 100 percent of inside pipe diameter, use flow control methods as specified for bypass pumping system, to eliminate surcharging and reduce flow.

### **3.7 PROTECTION OF FINISHED WORK**

- A. Section 01 78 00 – Closeout Submittals: Requirements for protecting finished Work.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

**END OF SECTION**

**SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING**

**PART 1 GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Storm drainage piping.
2. Accessories.
3. Underground pipe markers.
4. Catch basins, trench drains & landscape area drains.
5. Cleanouts.
6. Bedding and cover materials.
7. Slope protection at culvert pipe end.
8. Building perimeter drainage system.
9. Retaining wall drainage system.
10. Riprap placed loose.

**B. Related Sections:**

1. Section 31 05 13 - Earthwork
2. Section 32 91 19 - Landscape Grading, Topsoil, and Soil Preparation
3. Section 33 05 13 - Manholes and Structures.
4. Section 33 31 00 - Sanitary Utility Sewerage Piping:

**1.2 REFERENCES**

**A. ASTM International:**

1. AASHTO M252 - Specification for Corrugated Polyethylene Pipe, 3 - to 10-In. Diameter.
2. AASHTO M288 – Specification for Geotextiles Specification for Highway Applications
3. AASHTO M294 - Specification for Corrugated Polyethylene Pipe, 12- to 36-In. Diameter.
4. ASTM D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> ).
5. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
6. ASTM D2729 - Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
7. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
8. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
9. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

10. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
  11. ASTM F2418 - Standard Specification for Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers.
  12. ASTM F2787 - Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers
  13. ASTM F2922 - Specification for Polyethylene (PE) Corrugated Wall Stormwater Collection Chambers.
  14. AWWA C900
- B. Oregon Department of Transportation/American Public Works Association
1. OSSC refers to the current edition of the State of Oregon/ APWA, Standard Specifications for Construction.

### **1.3 DEFINITIONS**

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

### **1.4 SUBMITTALS**

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data indicating pipe, pipe accessories, and material to be used in the work.
- C. Manufacturer's Installation Instructions: Submit special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

### **1.5 CLOSEOUT SUBMITTALS**

- A. Section 01 78 00 – Closeout Submittals: Requirements for submittals.
- B. Project Record Documents:
1. Accurately record actual locations of pipe runs, connections, basins, cleanouts, and invert elevations.
  2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
- C. Provide manufacturer warranty information.

### **1.6 QUALITY ASSURANCE**

- A. **All Work in the public rights of way or easements dedicated to the public shall be in accordance with the local Governing Authority having Jurisdiction.**

- B. All Work outside public rights of way shall conform to Oregon Plumbing Specialty Code for materials and installation of the Work of this section.
- C. Furnish each riprap & aggregate material from single source throughout the Work.
- D. Maintain one copy of each document on site.

## **1.7 COORDINATION**

- A. Contractor shall coordinate project conditions.
- B. Coordinate the Work with termination of storm sewer connection outside building, trenching, connection to foundation drainage system and municipal sewer utility service.

## **PART 2 PRODUCTS**

### **2.1 PIPE MATERIALS**

- A. Plastic Pipe: ASTM D3034, Type PSM, Poly (Vinyl Chloride) (PVC) material; inside nominal diameter as shown on the drawings inches, bell and spigot style rubber ring sealed gasket joint.
  - 1. Fittings: PVC.
  - 2. Joints: ASTM F477, elastomeric gaskets.
- B. Corrugated Polyethylene Pipe (CPE): AASHTO M252 or M294 type S smooth interior, bell and spigot style, ADS, Hancor Sure-Loc or approved equal.
  - 1. Fittings: CPE.
  - 2. Joints: Water Tight.
- C. Perforated Corrugated Polyethylene Pipe (CPE): AASHTO M252 or M294 type S smooth interior, bell and spigot style, ADS, Hancor Sure-Loc or approved equal.
- D. Corrugated Plastic Tubing: Flexible type; inside diameter as shown on drawings, with required fittings.

### **2.2 BEDDING AND COVER MATERIALS**

- A. Bedding: Fill Type as specified in Section 31 05 13.
- B. Cover: Fill Type as specified in Section 31 05 13.
- C. Subdrainage pervious Fill Materials: 1 ½" – ¼" clean drain rock.

### **2.3 ACCESSORIES**

- A. Geotextile Fabric: Non-biodegradable, woven & non-woven.
  - 1. AMOCO
  - 2. Mirafi

3. Tensar Earth Technologies, Inc.
  4. Substitutions: Section 01 60 00 - Product Requirements
- B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, clean-outs, reducers, traps and other configurations required.
- C. Trace Wire: Magnetic detectable conductor, clear, brightly colored plastic covering, imprinted with " Storm Sewer Service " in large letters. Brimar or approved equal.

## **2.4 CATCH BASINS, TRENCH DRAINS, AREA DRAINS AND OVERFLOW STRUCTURES**

- A. Trapped Inlets: Square, Lynch style catch basin. Gibson Steel or approved equal
1. H20 Load rated, 10 guage asphalt dipped steel.
  2. Lid design: Square, bike proof linear grill .
  3. Nominal lid and frame size: as shown on drawings.
- B. Area Drain: Square 10 ga. asphalt dipped as indicated on the Drawings. Gibson Steel or approved equal.
- C. Trench Drain: ACO Drain Klassik Drain or approved equal.
- a. Grate: ACO 661Q, meeting ADA requirements, ACO Drain – Iron slotted grate or approved equal.
  - b. Catch Basin: ACO Drain K200 or approved equal.
- D. Overflow Structure: Size, material, and product as indication on drawings.

## **2.5 CLEANOUTS**

- A. Cleanout Lid and Frame: Cast iron construction, as indicated on drawings.
1. Lid Design: Standard cast iron frame and cover.
- B. Shaft Construction: Of the same material as the pipe, nominal shaft diameter of eight inches.
- C. Base Pad: Cast-in-place concrete: 3000 psi.

## **2.6 BEDDING AND COVER MATERIALS**

- A. Bedding: Fill Type as specified in Section 31 05 13.
- B. Cover: Fill Type as specified in Section 31 05 13.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Contractor shall coordinate verification of existing conditions before starting work.

- B. Do not place riprap bags over frozen or spongy subgrade surfaces.
- C. Verify trench cut or excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

### **3.2 PREPARATION**

- A. Hand trim excavations to required elevations. Correct over excavation with fine or coarse aggregate.
- B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

### **3.3 BEDDING**

- A. Excavate pipe & culvert trench in accordance with Section 31 05 13 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 8 inches compacted depth.
- C. Maintain optimum moisture content of bedding material to attain required compaction density.

### **3.4 INSTALLATION – STORM UTILITY PIPE**

- A. Install pipe, fittings, and accessories in accordance with ASTM D2321. Seal joints watertight.
- B. Lay pipe to slope gradients noted on drawings with maximum variation from indicated slope of 1/8 inch in 10 feet.
- C. Install aggregate at sides and over top of pipe. Install top cover to minimum compacted thickness of 12 inches.
- D. Refer to Section 31 05 13 for backfilling and compacting requirements. Do not displace or damage pipe when compacting.
- E. Refer to Section 33 05 13 for manhole requirements.
- F. Connect to building drain outlet and municipal storm sewer system.
- G. Install trace wire and colored marker tape continuous over top of pipe; coordinate with Section 31 05 13.
- H. Connect to subdrainage tile system piping.
- I. Install perforated pipe with perforations facing down. Mechanically join pipe ends.

- J. Place pervious fill over perforated drainage pipe aggregate cover and compact.
- K. Install storm detention chambers system per manufacturer's recommendations.

### **3.5 INSTALLATION - CATCH BASINS, TRENCH DRAINS AND CLEANOUTS**

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Level top surface of base pad; sleeve concrete shaft sections to receive storm sewer pipe sections.
- C. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.
- D. Mount lid and frame level in grout/concrete to elevation indicated
- E. Install trench drains as shown on the drawings and per manufacturer's recommendations.

### **3.6 RIPRAP PLACEMENT**

- A. Place geotextile fabric over substrate, overlap edges and ends.
- B. Place riprap at culvert pipe ends and at embankment slopes as indicated on Drawings.
- C. Installed Thickness: As shown on the drawings.

### **3.7 STORM UTILITY INSTALLATION TOLERANCES**

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Lay pipe to alignment and slope gradients noted on Drawings; with maximum variation from indicated slope of 1/8 inch in 10 feet.
- C. Maximum Variation From Intended Elevations: 1/4 inch.
- D. Maximum Offset From Indicated Alignment: 1 inch.

### **3.8 FIELD QUALITY CONTROL**

- A. Section 01 40 0 - Quality Requirements and 01 78 00 – Closeout Submittals: Field inspecting, testing, adjusting, and balancing.
- B. Install Work in accordance with Oregon Plumbing Specialty Code
- C. Request inspection as required by the Governing Authority having jurisdiction.
- D. Compaction Testing: In accordance with ASTM D1557, ASTM D2922, ASTM D3017.
- E. When tests indicate work does not meet specified requirements, remove work, replace and retest.

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- F. Frequency of Compaction Tests: per section 31 05 13.
- G. Deflection and Pressure Test: Test in accordance with Uniform Plumbing Code requirements.

**3.9 PROTECTION OF FINISHED WORK**

- A. Section 01 78 00 – Closeout Submittals: Protecting finished Work.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
  - 1. Take care not to damage or displace installed pipe and joints during construction of pipe supports, backfilling, testing, and other operations.
  - 2. Repair or replace pipe that is damaged or displaced from construction operations.

**END OF SECTION**