



---

**GENERAL NATIONAL AIR SPACE**

U. S. Department of Transportation Federal  
Aviation Administration

**Service Support Work Center (SSWC) New Construction and Site Improvements  
at Missoula, MT**

**Specifications**

**Work Release ANT-2242**

**PREPARED BY:**

**PARSONS  
T4 National Technical Office  
955 L'Enfant Plaza North, SW, Suite 6100  
Washington, DC 20024**

## TABLE OF CONTENTS

### SPECIFICATIONS

SECTION 01 10 00	SUMMARY OF WORK
SECTION 01 31 13	PROJECT COORDINATION
SECTION 01 32 00	CONSTRUCTION PROGRESS DOCUMENTATION SHORT FORM
SECTION 01 32 10	CONSTRUCTION PROGRESS DOCUMENTATION
SECTION 01 33 00	SUBMITTAL PROCEDURES
SECTION 01 35 26	GOVERNMENTAL SAFETY REQUIREMENTS
SECTION 01 35 29	HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES
SECTION 01 45 00	QUALITY CONTROL
SECTION 01 50 00	TEMPORARY FACILITIES AND CONTROLS
SECTION 01 60 00	PRODUCT REQUIREMENTS
SECTION 01 71 33	PROTECTION OF ADJACENT CONSTRUCTION
SECTION 01 74 00	CLEANING AND WASTE MANAGEMENT
SECTION 01 77 00	CLOSEOUT PROCEDURES
SECTION 02 31 00.13	SUBSURFACE UTILITY INVESTIGATION
SECTION 02 40 00	DEMOLITION
SECTION 02 93 00	EXTERIOR PLANTING
SECTION 03 00 00	CONCRETE
SECTION 03 35 19	STAINED CONCRETE FINISHES
SECTION 04 21 13.13	NONBEARING MASONRY VENEER
SECTION 05 12 00	STRUCTURAL STEEL FRAMING
SECTION 05 12 00.10	STRUCTURAL STEEL ERRETION
SECTION 05 50 00	METAL FABRICATION
SECTION 06 41 00	MILLWORK
SECTION 07 21 01	SOUND ATTENUATION BLANKETS
SECTION 07 92 00	JOINT SEALANTS
SECTION 08 11 13	HALLOW METAL DOORS AND FRAMES
SECTION 08 14 16	FLUSH WOOD DOORS
SECTION 08 51 13	ALUMINUM WINDOWS
SECTION 08 71 00	DOOR HARDWARE
SECTION 09 22 16:	NON-STRUCTURAL METAL FRAMING
SECTION 09 29 00	GYPSUM BOARD

SECTION 09 30 00	TILING
SECTION 09 51 13:	ACOUSTICAL PANEL CEILINGS
SECTION 09 65 13:	RESILIENT BASE AND ACCESSORIES
SECTION 09 65 19:	RESILIENT TILE FLOORING
SECTION 09 68 13:	TILE CARPETING
SECTION 10 14 00:	SIGNAGE
SECTION 10 28 00:	TOILET ACCESSORIES
SECTION 10 44 16	FIRE EXTINGUISHERS
SECTION 13 34 19	METAL BUILDING SYSTEM
SECTION 22 05 00	COMMON WORK RESULTS FOR PLUMBING
SECTION 22 05 29	HANGERS AND SUPPORTS FOR PLUMBING
SECTION 22 05 53	IDENTIFICATION FOR PLUMBING
SECTION 22 07 00	PLUMBING INSULATION
SECTION 22 11 16	DOMESTIC WATER PIPING
SECTION 22 11 19	DOMESTIC WATER PIPING SPECIALTIES
SECTION 22 11 23	NATURAL GAS PIPING
SECTION 22 13 16	SANITARY WASTE AND VENT PIPING
SECTION 22 13 19	SANITARY WASTE PIPING SPECIALTIES
SECTION 22 40 00	PLUMBING FIXTURES
SECTION 23 05 00	COMMON WORK RESULTS FOR HVAC
SECTION 23 05 29	HANGERS AND SUPPORTS FOR HVAC EQUIPMENT
SECTION 23 05 93	TESTING, ADJUSTING, AND BALANCING
SECTION 23 07 00	HVAC INSULATION
SECTION 23 31 13	METAL DUCTS
SECTION 23 33 00	AIR DUCT ACCESSORIES
SECTION 23 73 13	PACKAGE AIR CONDITIONING (AC) UNITS
SECTION 26 05 00	COMMON WORK RESULTS FOR ELECTRICAL
SECTION 26 05 00.10	BASIC ELECTRICAL MATERIALS AND METHODS
SECTION 26 05 19	LOW VOLTAGE CABLES
SECTION 26 05 26	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
SECTION 26 05 29	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
SECTION 26 05 33	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
SECTION 26 05 33.10	UNDERGROUND CONDUITS FOR ELECTRICAL SYSTEMS
SECTION 26 05 53	IDENTIFICATION OF ELECTRICAL SYSTEMS
SECTION 26 08 00.13	TESTING AND INSPECTING ELECTRICAL EQUIPMENT
SECTION 26 09 23	LIGHTING CONTROL DEVICES
SECTION 26 24 16	PANELBOARDS

SECTION 26 27 26	LOW VOLTAGE WIRING DEVICES
SECTION 26 28 00	ENCLOSED SWITCHES AND CIRCUIT BREAKERS
SECTION 26 28 13	FUSES
SECTION 26 43 13	TRANSIENT- VOLTAGE SUPPRESSION FOR LOW-VOLTAGE ELECTRICAL POWER
SECTION 26 51 00	INTERIOR LIGHTING FIXTURES
SECTION 26 56 00	EXTERIOR LIGHTING FIXTURES
SECTION 31 00 00	EARTH WORK
SECTION 31 23 00	EXCAVATION AND FILL
SECTION 31 23 16.13:	TRENCHING
SECTION 31 25 00	EROSION AND SEDIMENT CONTROLS
SECTION 32 12 16	ASPHALT PAVING
SECTION 32 31 00	CHAIN LINK FENCES AND GATES
SECTION 32 92 19	SEEDING

ATTACHMENTS:

- A - LIST OF PROJECT DRAWINGS
- B - GEOTECHNICAL SURVEY REPORT
- C - TOPOGRAPHICAL SURVEY REPORT
- D - SOIL TESTING REPORT
- E – FAA-C- 1391d                      INSTALLATION AND SPLICING OF UNDERGROUND CABLES
- F – FAA-C-1217G                      ELECTRICAL WORK, INTERIOR

**SECTION 01 11 00**  
**SUMMARY OF WORK**

**PART 1            GENERAL**

**1.1    Summary**

- A. This Section includes the following:
1. Work covered by the Contract Documents.
  2. Type of the Contract.
  3. Work phases.
  4. Work under other contracts.
  5. Products ordered in advance.
  6. Contractor-furnished products.
  7. Use of premises.
  8. Contractor's occupancy requirements.
  9. Work restrictions.
  10. Specification formats and conventions.
  11. Miscellaneous Provisions

**1.2    Work Covered by the Contract Documents**

- A. Project Location: 7150 Highway 10 W, Missoula, MT 59808
- B. The work consists of the following:
- Construction of approximately 2,500 SF mixed used building
  - Construction of a paved parking lot and access road from the main road to the building
  - Installation of a property perimeter chain link fence and automatic gate
  - Providing new utility connections to the building
  - Drilling a water well and installing a pump in the well
  - Landscaping the area around the new building
- C. The Subcontractor is responsible for accomplishing all items of work in accordance with the applicable drawings, specifications and conditions of the subcontract. Any additional labor, materials, equipment, and/or appurtenances not specifically detailed or specified, but required to complete the project, must be provided by the Subcontractor as an integral part of the scope of work specified.

**1.3    Type of Contract**

- A. Project will be constructed under a single prime subcontract.

**1.4    Work Phases**

- A. The Work shall be conducted in one phase.
1. Work shall be substantially complete and ready for occupancy within 150 days after the Notice to Proceed.
  2. The Work shall be substantially complete and ready for occupancy at time of Substantial Completion.

**1.5    Work under Other Contracts**

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

- B. Concurrent Work: Contractor **will award** separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
  - 1. Local Telecommunication Company: A separate contract **will be** awarded to Local Telecommunication Company to provide a fiber optic cable to the new building.

#### **1.6 Products Ordered in Advance “Not in Use”**

#### **1.7 Contractor or Government Furnished Property “Not in use”**

#### **1.8 Use of Premises**

- A. Access to the Worksite: Access to the Worksite must be with approval of the RE. Access to the Worksite will be discussed prior to the start of actual construction. Only vehicles essential to the construction effort will be permitted in the construction area.
- B. Restrictions: Access to certain locations of the project may be restricted due to facility operations. Subcontractor must yield to facility operations that require use of the premises, and when instructed must vacate the area in question. Unless otherwise indicated, Subcontractor will have complete and exclusive use of the premises within the limits of the construction staging area for the execution of the Work.
- C. General: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period. Contractor's use of premises is limited only by Contractor's right to perform work or to retain other contractors on portions of Project.
- D. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.
- E. Use of Site: Limit use of premises to **areas within the Contract limits** indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  - 1. Limits: Confine constructions operations to **areas where work is permitted**.
    - a. Limit site disturbance, including earthwork and clearing of vegetation, to 40 feet beyond building perimeter; 10 feet beyond surface walkways, patios, surface parking, and utilities less than 12 inches in diameter; 15 feet beyond primary roadway curbs and main utility branch trenches; and 25 feet beyond constructed areas with permeable surfaces (such as pervious paving areas, storm water detention facilities, and playing fields) that require
  - 2. FAA Occupancy: Allow for FAA occupancy of Project site **and use by the public**.
  - 3. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to FAA, FAA's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- F. Use of Existing Building: Maintain existing building in a weather tight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

#### **1.9 Contractor’s Occupancy Requirements “Not in Use”**

#### **1.10 Work Restrictions**

- A. On-Site Work Hours: Work shall be generally performed during normal business working hours of 7:00 a.m. to 6:00 p.m., Monday through Friday, except otherwise indicated.
  - 1. Weekend Hours: No restrictions
  - 2. Early Morning Hours: No restrictions
  - 3. Hours for Utility Shutdowns: No restrictions

- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by FAA or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Resident Engineer not less than **two** days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Resident Engineer's or Project Manager's written permission.
- C. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor air intakes.

### 1.11 Specification Formats and Conventions

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "Master Format" numbering system.
  - 1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
  - 2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
  - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
    - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

### 1.12 Miscellaneous Provisions

- 1. On-Site Communications:
  - A. Compliance with Local and Other Codes: The Subcontractor will be responsible for coordination of all Work. The Subcontractor must obtain any licenses or permits necessary to perform the Work not provided by the Contractor, and must comply with all applicable Federal, State, and local regulations in connection with the Work. The Subcontractor is responsible for paying for any permits or licenses required to perform the Work not provided by the Contractor, and such costs are deemed included in the Subcontract amount. The Contractor is not responsible for payment of any amount for actions taken by a state, local, or other jurisdiction as a result of Subcontractor's failure to comply with permit or license requirements.
  - B. Liquidated Damages: If the Subcontractor fails to complete the Work within the time specified in the Task Order for all Task Order work, or the work associated with interim milestones, or any extension to either, the Subcontractor shall pay to Contractor as liquidated damages, the sum of **\$1, 200** for each day of delay

### 1.13 Layout of Work

- A. The Subcontractor must layout its work from established base lines and bench marks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Subcontractor should furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor

required to lay out any part of the Work. The Subcontractor will be responsible for the execution of the Work to the lines and grades that may be established or indicated by the RE. The Subcontractor must also be responsible for maintaining and preserving all stakes and other marks established by the Contractor until authorized to remove them. If such marks are destroyed by the Subcontractor or through its negligence before their removal is authorized, the Contractor may replace them and deduct the expense of the replacement from any amounts due or to become due to the Subcontractor.

## **PART 2            PRODUCTS            [NOT USED]**

## **PART 3            EXECUTION**

### **3.1    Submittals Required for Notice to Proceed**

- A. Start of project work cannot occur until the Subcontractor has been provided a written NTP from the SA. Submittals required for NTP must be submitted to the PM prior to the Pre-Construction Meeting. Work cannot commence until interim or final approval is provided for submittals required for NTP. Payment and Performance Bonds (if required) and Certificates of Insurance must be submitted to the SA. The SA will advise the Subcontractor if bonds or insurance submittals are not acceptable.
- B. Submittals required for NTP are discussed in this section as well as other sections of the General Requirements (Division 1) and Subcontract. Required submittals of NTP include:
  - 1. Payment and Performance Bonds **are** required.
  - 2. Project Specific Insurance Requirements.
  - 3. Risk Management Plan
  - 4. Construction Progress Schedule
  - 5. Schedule of Values
  - 6. Submittal Schedule
  - 7. List of Lower Tier Subcontractors, Suppliers, and Fabricators
  - 8. Initial List of Personnel Working On-Site
  - 9. List of Subcontractor Staff Assignments and Project Organization Chart

### **3.2    Payment and Performance Bonds**

- A. Bonds must comply with the requirements of Section H.16 of the Subcontract, and be on the bond forms provided by the SA.

### **3.3    Project Specific Insurance Requirements**

- A. Certificates of Insurance (COI): Subcontractor must submit COI(s) to the SA in accordance with Section H of the Subcontract. In addition to Waiver of Subrogation and other requirements of Sections H, each COI shall include, in the "Description of Services" section of the ACORD Form, the Subcontract Number, Location of the Project, and the following statement: "As required by written contract, the following entities are covered as additional insureds on a primary basis with regards to general and employers liability: PTSI Managed Services Inc., Parsons Corporation and its subsidiaries, and the United States of America acting by and through the Federal Aviation Administration. Waiver of subrogation applies as required by contract."
- B. Project Specific Requirements: In addition to the insurance requirements specified in Section H.17 of the Subcontract, the following project specific insurance requirements apply:
  - 1. Builder's Risk Insurance. The Subcontractor will provide and maintains Builder's Risk Insurance for the materials, supplies, machinery, fixtures, and equipment, which will become a part of the installation, fabrication, or erection project as shown in the Contract Documents. Coverage under the Subcontractor's Builder's Risk Insurance shall pay for direct physical loss to property while in transit; at the site of installation, fabrication, or erection, as shown and described in the Contract Documents;



and in storage awaiting installation, fabrication, or erection. The Subcontractor's Builder's Risk Insurance shall be sufficient to cover the value of the installation. The Subcontractor shall be solely responsible for any deductibles carried under its Builder's Risk Insurance.

- C. Other Additional Insureds: In addition to the requirements of paragraph 3.4 A. above, the Subcontractor's insurance policies must be endorsed to include other entities as additional insured as required by the FAA. In addition to the insurance requirements set out in Section H of the Subcontract, the Subcontractor shall provide the following additional insurance coverage: none. No work may be performed and no vehicle or equipment may enter the construction site unless the proper insurance has been provided. The Subcontractor must obtain the most recent endorsement forms from the FAA. Certificates of Insurance shall be forwarded to Certificate Holders designated by the Additional Insured in accordance with this clause.
- D. Required Limits of Insurance. The insurance requirements set out in Section H of the Subcontract are minimum requirements for this Project. Coverage for General Liability and Automobile Liability Insurance shall be in accordance with the requirements of the the FAA comprised of such primary and excess policies of insurance as the Subcontractor find feasible to purchase during the term of the Subcontract to meet the requirements. The insurance requirements set out in Section H.17 of the Subcontract are hereby modified as follows:
1. The insurance coverage for Commercial General Liability Insurance, including Contractual Liability and Completed Operations coverage, is hereby modified with limits of not less than two *million dollars* (2,000,000) combined single limits.
  2. The insurance coverage for Automobile Liability Insurance set out in subparagraph 5.1A.3 of the General Conditions is hereby modified to provide all required coverage with limits of not less than *one million dollars* (\$1,000,000) combined single limit.

### 3.4 Project Safety and Quality

- A. Risk Management Plan: Subcontractor must develop a RMP that covers safety and quality for the project. The RMP must be submitted for approval in accordance with Section H.10 of the Subcontract. Construction shall not commence until the RMP has been approved by the PM.
- B. On Site Communications: Appropriate on site communications must be established with the RE and Subcontractor to disseminate all information pertaining to safety requirements on site. This will include the notification of hazards brought on the site or created during the course of the work. Notification may be done by posting hazard sheets on notice boards, or advising personnel during regular Toolbox Talks or daily meetings.
- C. Project Induction: All persons starting work on this site must go through a formal induction process and be briefed on a regular basis on changes in safety requirements depending on the progress of the Work. As part of the induction process, and as appropriate, the Subcontractor will be required to provide evidence of employee skills training.
- D. Competent Persons: Competent person training documentation must be provided where required by 29 CFR 1910 and 29 CFR 1926, such as for fall protection, excavations over four feet deep, crane and rigging operations, working in confined spaces, lockout/tagout of energy sources and equipment, and working with live electricity. Additional training records may be required on a case-by-case basis.
- E. Toolbox Meetings: Toolbox Meetings will be scheduled on a daily basis and used to discuss safety rules and various site specific issues. The aim is to ensure that all workers on site are aware of the hazards as they arise and equally to be advised when they no longer exist.
- F. List of On Site Personnel: A list of all Subcontractor personnel as well as a list of lower tier subcontractor personnel working on site must be maintained. The list of on site personnel must be provided to the RE on a daily basis.

- G. Liaison Person: If English is a second language of Subcontractor employees, then Subcontractor must maintain on site a liaison person who can effectively communicate with on-site personnel. Subcontractor must also have a person on site that is trained in First Aid in case of an injury or accident to any of its personnel.
- H. Hazard Analysis: All hazards brought on site or created during the course of the Work must be identified and controlled. Activity Hazard Analysis (AHA) should be used to analyze the tasks within the various elements of work to identify significant safety hazards and detail the method of control. Hazardous substances that may be used on site must have the appropriate MSD Sheets and be addressed as part of the AHA analysis.
- I. Accident Reporting: All serious harm accidents must be reported immediately to the RE. Accident and investigation reports are to be copied to the RE and PM within 48 hours. Accident scenes must not be disturbed until a full and complete accident investigation has been undertaken with the RE and other required personnel.
- J. Subcontractor Safety Inspections: The Subcontractor is expected to carry out regular documented safety inspections (minimum weekly) on its work areas while on site. Copies of the inspection reports must be provided to the RE for discussions at safety meetings. Any recommended completed corrective action will be advised at these meetings.

### **3.5 Pre-Construction Meeting**

- A. The SA will schedule a pre-construction meeting after Notice of Award. Required attendance includes Subcontractor, Subcontractor's Superintendent, and major lower tier subcontractors. An agenda will be provided, but must include at a minimum the review of the submittals required for NTP. The Subcontractor must submit other items, including those identified in Section G of the Subcontract, for review at the meeting. Acknowledgements of all the reviews made at the session will be noted in the meeting minutes.

### **3.6 Site Inspection**

- A. The Contractor reserves the right to enter the premises during the term of the Subcontract for quality assurance work inspections and/or maintenance of existing navigational and communication facilities.
- B. After NTP and prior to initiating Work, Subcontractor and RE must conduct joint inspections of the jobsite to determine the existing conditions and note any existing damage or defects. Existing damage or defects will be used as the basis for determination of damages caused by the Subcontractor's operations.
- C. Subcontractor will be responsible for the cost of any repair caused by Subcontractor's operations or the operations of its lower tier subcontractors. All damage to the existing Site including, but not limited to, existing utilities and cables, facilities, equipment, buildings, and vegetation must be repaired. All such repairs must match the original finish and must be made utilizing materials, equal to or greater than the original materials, as approved by RE. All repairs must be made with no additional cost to Contractor.
- D. Contractor retains the right to inspect all Work on the project, but has no obligation to do so. Contractor's inspections and tests are for the sole benefit of Contractor and do not:
  - 1. Relieve the Subcontractor or its lower tier subcontractors of the responsibility to provide adequate quality control measures.
  - 2. Relieve the Subcontractor or its lower tier contractors of the responsibility for damage to or loss of material before acceptance.
  - 3. Constitute or imply acceptance.
- E. The presence or absence of the RE does not relieve the Subcontractor or its lower tier contractors from any Subcontract requirement, nor is the RE authorized to change any requirement of the Subcontract.

### **3.7 Special Scheduling Requirements**

- A. Protect existing facilities and equipment from physical or electrical damage as a result of accidental or incidental negligence, such as, but not limited to, disruption of standby power to the facility or equipment.

- B. All preparatory work must be completed by the Subcontractor prior to shutdown/cutover to minimize downtime. The requested time and date of shutdown and cutover must be approved by the RE a minimum of two working days in advance of the requested shutdown or cutover. Contractor personnel will perform the actual shutdown/cutover of systems that affect operations.
- C. In the event any services are interrupted, restore services with a full crew available to restore such services on a 24-hour basis, including Work during holidays and weekends, at no additional cost to Contractor or delay in the Schedule.
- D. Request any utility interruptions in writing per Facility requirements but not less than five working days before the scheduled interruption, unless otherwise specified. RE review is required before interruption. In this notification, the Subcontractor must certify that all equipment, materials, and personnel necessary to conduct such testing will be available on the scheduled date and that the systems have been pre-checked by personnel and are ready for performance and acceptance testing.
- E. Subcontractor must also confirm that all operations and maintenance manuals have been submitted and approved. No performance and acceptance testing will be permitted until the operations and maintenance manuals have been approved.
- F. At the option of Contractor, Contractor and Contractor personnel will travel to the site to witness testing. If the testing must be postponed or canceled for whatever reason not the fault of the Contractor, the Subcontractor must provide Contractor at least three working days advance written notice of this postponement or cancellation.
- G. Coordinate all required outages with Contractor through the RE. The Subcontractor must determine quantity and duration of outages required to complete the Work. The Subcontractor may have to schedule work and outages at a time when air traffic is at a minimum. This could mean late night or early morning hours.
- H. Do not interrupt services outside of permitted, scheduled outage periods.

### **3.8 Project Specific Work Plans**

- A. Required Work Plans: The Subcontractor shall be required to submit written work plans in accordance with the Subcontract submittal requirements for critical items of work set out in this Section, in the Technical Specifications, or elsewhere in the Contract Documents. Work associated with the required work plans shall not commence until approval has been provided.
- B. Underground Utility Damage Prevention Work Plan: Subcontractor is responsible for complying with all OSHA regulations related to underground utility damage prevention. Subcontractor shall take all reasonable steps necessary to make certain that all active, abandoned, or unknown utilities are identified. Such steps are to include the utilization of an individual or firm acceptable to the Contractor and knowledgeable in Subsurface Utility Engineering (SUE) techniques.
  - 1. Preparation
    - a. All existing underground utilities depicted on the drawings, (which include but are not limited to: power, control, and communications cables; telephone, water and sewer lines; and other utilities) are shown in their approximate locations only. Other utility lines may exist but not be depicted. It is the Subcontractor's responsibility to ensure that locations of all underground airport, Contractor, public, and/or private utilities are established prior to work in the area.
    - b. Subcontractor shall at its expense satisfactorily repair and/or pay the cost of repair for all damages to underground utilities that result from the Subcontractor's or its lower tier subcontractors' operations during the period of the Subcontract. The Subcontractor is responsible for completing any required repair work to any underground utility that is damaged by its workers, equipment, work, or subcontractors immediately, and with equal material approved by the RE.
    - c. If the Subcontractor damages a cable that has been previously located, then the Subcontractor shall be required to repair the cable and, at its expense, install either a pull box or manhole depending on the type and/or size of the cable. The RE will determine whether a pull box or manhole is

required. All costs related to the repair of the damaged cable shall be the responsibility of the Subcontractor.

- d. Do not interrupt existing utilities serving facilities occupied by the Government or others except when permitted in writing by the RE and then only after acceptable temporary utility services have been provided. Provide a minimum 48-hours notice to the RE. Do not proceed with the interruption of any utility without written notice from the RE.
  - e. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
  - f. Protect subgrade and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary. Protect subgrade and foundation soils from softening and damage by rain or water accumulation.
  - g. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
2. Pre-excavation Requirements for Underground Utility Installations.
- a. Prior to any excavation, the Subcontractor shall layout in the field the centerline of all proposed utilities. In addition the Subcontractor shall white line (by white spray paint or other means acceptable to the RE) the limits of construction including the area(s) to be excavated. The Subcontractor shall also identify the proposed placement of grounding rods and cathodic protection.
  - b. The Subcontractor shall identify the location of existing underground utilities on as-built drawings, including any unknown or abandoned utility found during construction. The Subcontractor shall ensure that all Airport officials, Contractor technicians, other utility owners/operators, and any One-Call System performing utility designation/location services designate/mark existing utilities within the construction limits as well as the entire path of excavation, including five feet to either side of proposed utilities. The Subcontractor shall be solely responsible for notifying relevant utility owners/operators and One-Call System sufficiently in advance to ensure that delays to construction does not occur.
  - c. After completion of the utility designation described above, the Subcontractor shall hire a professional Subsurface Utility Engineering (SUE) or utility designation/locating company, to designate and sweep the entire excavation area, including five feet to either side of proposed utilities, to confirm the locations of the marked utilities and identify and mark any additional unidentified utilities that may be within the limits of excavation.
  - d. The Subcontractor shall notify the RE of the preferred date and time for a pre-work meeting for all excavation work. The RE will coordinate the pre-work meeting with utility owners, local Airport Authority, Contractor, the Subcontractor, and others as applicable to walk the excavation area and review applicable documentation. The subcontractor shall arrange to have its excavator and SUE (or designation firm) at the pre-work meeting. The Subcontractor shall provide a written excavation work plan that includes a contingency plan to restore to service all utilities including cables that may be placed out of service or damaged during performance of the work. The work plan at a minimum must include:
    - i. A list of qualified subcontractors such as plumber, electrician, fiber optical cable splicer, and others as applicable for emergency repair purposes. Due to current Contractor/TSA/Airport security requirements, the Subcontractor shall ensure that these subcontractors have passed any airport security and registration requirement so they can be presented immediately at the job site when emergency repair is warranted.
    - ii. The Subcontractor shall coordinate with the RE to request an Emergency Procedures Plan from the Airport Authority or facility manager. This plan will outline special procedures during emergencies, disasters, accidents and injuries. The Subcontractor shall review the Emergency Procedures Plan with all its personnel prior to construction and every quarter thereafter.

- iii. The Subcontractor shall investigate and provide a list of sketches/drawings to all disconnects to electrical circuits, jet fuel lines, natural gas, and main water sources that feed the services in the project area and its vicinity. All disconnects and shut-off valves shall be noted with special notation and procedures if required by the utility owners/operators.
  - iv. Name of the SUE or utility designation firm including training and experience of the technician who will be performing the utility designation as well as equipment that will be used for sweeping the area to be excavated.
  - v. Name of the excavator including training and experience of the equipment operator who will be doing the work.
- e. Subcontractor shall expose all utilities that it will be crossing through non-destructive mechanical excavation methods such as vacuum excavation or similar mechanical method(s) approved by the RE (“potholing”) or by hand digging. When a cable is located, the Subcontractor shall hand-excavate a trench five (5) feet each side of the exposed cable to verify that another cable is not adjacent to the exposed cable. All critical or high priority facilities must be exposed by potholing or hand digging every 100 feet (or less if on a curve) if the Subcontractor is working on or parallel to a critical or high priority utility. All exposed utilities must be properly supported and protected during construction.
  - f. Subcontractor shall continuously maintain utilities, facilities and/or systems that are or may be affected by work associated with the project. The Subcontractor shall provide the RE with written reports on any cable cuts.
  - g. If the Subcontractor does not find an underground utility that was previously marked, the excavation shall be stopped, the RE shall be notified, and the Subcontractor shall contact the appropriate owner/operator of the utility or make contact with the appropriate owner/operator, using the One-Call System when warranted.
  - h. Every attempt shall be made to preserve the location markings during excavation. Location markings that are no longer visible shall be refreshed by calling the one-call system and/or the utility owners/operators for remarking.
  - i. All existing utilities that have been exposed during exploratory potholing or excavation must be supported to prevent stretching, kinking, or damage to the existing utility.
3. Excavation
- a. Preserve, protect and maintain existing operable drains, sewers, and electrical ducts during grading, excavating and backfilling operations. Keep excavations dry. Locations indicated for existing utility facilities are approximate. Pipes or other manmade obstructions, in addition to those indicated, may be encountered. Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Subcontractor’s risk. Perform all work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility owner. Excavation made with power driven equipment is not permitted within five feet of any known existing utility. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered. Support uncovered lines until approval for backfill is granted by the RE. No excavated material shall be disposed of in such a manner as to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.
  - b. An observer, acceptable to the RE, shall be present to assist the equipment operator when operating equipment around known underground facilities and utilities. Adhere to the following during excavation:
    - i. All mechanized excavation shall start with 6 to 10 inches excavation on the surface. The equipment operator shall immediately cease operation and notify the RE if utility warning tapes, sand, or bedding material is uncovered at any time during excavation.
    - ii. All excavations within 5 feet of any pedestal, closure, riser guard, pole (with riser), meter, or other structure shall be performed by hand digging or other means such as vacuum excavating.

- iii. If the Subcontractor discovers damage, causes damage, or even contacts an existing underground utility, the owner/operator of that utility, and RE shall be notified immediately. The Subcontractor shall be responsible for making necessary repair and/or replacement in accordance with this section and the terms and conditions of the Subcontract.
  - iv. If there is a critical or high priority utility line in the dig area, make arrangements for the utility owner/operator to be on the job site during the excavation. If the utility owner/operator refuses to be present, document this response by appending it to the request form.
  - v. Only those subcontractor employees qualified by training, licensed or experienced (as appropriate) shall be permitted to operate machinery, tools or equipment.
- c. The Subcontractor and RE shall coordinate on a daily basis with the excavator and the excavating work crew regarding the work to be performed that day with an emphasis on the excavation work plan and anticipated utility crossings.
- C. Crane Work Plan:
- 1. Notify the RE at least 48 hours prior to the arrival of any crane at the work site.
  - 2. On the day of arrival of the crane at the work site, and every day the crane is at the work site thereafter, notify the RE of its presence and location.
  - 3. The following information for each crane must be given to the Resident Engineer:
    - Boom or lead height
    - Weight
  - 2. Crane must be grounded.
  - 3. Crane must have an up-to-date Certificate of Insurance.
  - 4. Crane operator must have an up-to-date Operator License.
  - 5. Crane must have appropriate flags and lights on top.
- D. Fall Protection Work Plan: The aim of the Fall Protection Work Plan is 100% Fall Protection. Whenever activities are to be performed 6 feet or higher above a lower level by subcontractor or lower-tier subcontract personnel, the Subcontractor shall:
- 1. Include a detailed Fall Protection Plan as part of the Safety and Health Plan submittal. The Fall Protection Plan shall identify specific situations where fall protection is required by all subcontract and lower-tier subcontract personnel who will be engaged in activities at elevations of 6 feet or higher, identify the fall protection system and associated components to be used, and explain the specific methods and procedures to be followed to assure 100% fall protection.
  - 2. 100% fall protection means that the employee is protected 100% of the time by an approved fall protection system regardless of activity. **100% of the time an employee is engaged in activities at elevations of 6 feet or higher; the employee must be protected - without exception.**
    - 2. Guardrail Systems when used as the means of fall protection on the job shall comply with 29 CFR 1926.502(b). Additionally, these systems shall:
      - a. Be provided on every open-sided floor or platform 4 feet or more above adjacent floor or ground level on all open sides, except where there is an entrance to a ramp, stairway, or fixed ladder.
      - b. Consist of a top rail, intermediate rail, and posts, and shall have a vertical height of 42 inches nominal from upper surface of top rail to floor, platform, runway, or ramp level. When used mid-rails shall be half the distance between the top rail and to floor, platform, runway, or ramp level.
      - c. Be capable of withstanding, without failure, a force of at least 200 pounds applied within 2 inches of the top edge of the top rail, in any outward or downward direction, at any point along the top edge.
      - d. Be capable of withstanding, without failure, a force of at least 150 pounds applied to the mid-rail, in any outward or downward direction.
      - e. Use toeboards or screens when objects could fall to a lower level.
  - 3. Safety Net Systems when used as the means of fall protection on the job site shall comply with 29 CFR 1926.502(c). Additionally, these systems shall:
    - a. Be installed as close as practicable under the walking/working surface on which employees are

working, but in no case more than 30 feet below such level.

- b. Extend outward from the outermost projection of the work surface as follows:

<i>Vertical distance from working level to horizontal plane of net:</i>	<i>Minimum required horizontal distance of outer edge of net from the edge of the moving surface:</i>
➤ Up to 5 feet	➤ 8 feet
➤ More than 5 feet up to 10 feet	➤ 10 feet
➤ More than 10 feet	➤ 13 feet

- c. Be capable of absorbing an impact force equal to that produced by the required drop test. The drop-tested shall be performed at the job site after initial installation and before being used as a fall protection system, whenever relocated, after major repair, and at 6-month intervals if left in one place. The drop-test shall consist of a 400 pound bag of sand 30 ± inches in diameter dropped into the net from the highest walking/working surface at which employees are exposed to fall hazards, but not from less than 42 inches above that level.
- d. Be installed with sufficient clearance under them to prevent contact with the surface or structures below when subjected to an impact force equal to the required drop test.
- e. Be inspected at least once a week for wear, damage, and other deterioration. Defective nets and components shall be removed from service.
- f. Be inspected daily, at the beginning and end of each shift, and all materials, scrap pieces, equipment, and tools which have fallen into the safety net must be removed as soon as possible from the net.
- g. Be inspected after any occurrence that could affect the integrity of the safety net system. Defective nets and components must be removed from service.
4. Personal Fall Arrest Systems when used as the means of fall protection on the job site shall comply with 29 CFR 1926.502 (d). The subcontractor shall identify, in writing, an observer to be present on the ground at all times when personnel are engaged in activities requiring the use of these systems. (This person shall have certification by training and experience as a competent person in fall protection and shall not have any other duties that will encumber the observing duties.) Additionally, these systems shall:
- Utilize full body harnesses (which meet ANSI A10.14-1991) to distribute the fall arrest forces as defined in 29 CFR 1926.500(b). **Body belts shall not be used.**
  - Utilize shock absorbing lanyards or retractable lifelines with locking type snap hooks to prevent "roll-out."
  - Limit the free fall distance, as defined in 29 CFR 1926.502(d)(16)(iii), to less than six feet and minimize associated swing hazards.
  - Ensure anchor points meet the 5,000-lb. strength requirements outlined in 29 CFR 1926.502(d)(15).
  - Ensure that all fall protection systems and components are inspected prior to each use and continue to be inspected by a competent person in accordance to the requirements set forth in 29 CFR 1926.502(d)(21). The Subcontractor shall maintain records of inspection at the job site for review by Parsons Personnel and/or regulatory agencies.
5. Positioning Device Systems must comply with 29 CFR 1926.502(e). The Subcontractor shall identify, in writing, an observer to be present on the ground at all times when personnel are engaged in activities requiring the use of these systems. (This person shall have certification by training and experience as a competent person in fall protection and shall not have any other duties that will encumber the observing duties.) Additionally, these systems shall:
- Utilize full body harnesses (which meet ANSI A10. 14-1991). **Body belts shall not be used.**
  - Utilize positioning lanyards with locking type snap hooks to prevent "roll-out."
  - Limit the free fall distance, as defined in 29 CFR 1926.502(e)(l), to less than two feet.

- d. Ensure anchor points meet the 3,000-lb. strength requirements outlined in 29 CFR 1926.502(e)(2).
- e. Ensure that all positioning device systems and components are inspected prior to each use and continue to be inspected by a competent person in accordance to the requirements set forth in 29 CFR 1926.502(e)(9). The Subcontractor shall maintain records of inspection at the job site for review by Parsons personnel and/or regulatory agencies.
6. Warning Lines and Controlled Access Zones when used as means of fall protection must comply with the requirements of 29 CFR I 926.502(f & g). Additionally, use of warning lines and controlled access zones must require the designation of a competent person to perform as a safety monitor. The competent person shall be on the same working level as employees, be able to readily observe and communicate orally with employees on the working level, and not have any other duties that will encumber the safety monitoring duties.
7. Fall Protection training shall be provided as described in 29 CFR 1926.503(a) and 29 CFR 1926.21(b)(2), be conducted by a competent person according to 29 CFR 1926.503(a)(2), and be current within 12 months of issuance of the Notice To Proceed.
8. A training certification record showing the names of employees trained, the date(s) of the training, training topics, and the signature of the trainer in accordance with 29 CFR 1926.503 (b & c) shall be submitted to Parsons.
9. A Notice To Proceed will not be issued until written evidence is received by Parsons showing compliance with the fall protection training requirement. All Subcontractor employees will be required to have, on file with Parsons, their training records before they will be permitted on the job site. Delays and related costs associated with the Subcontractor's failure to comply shall be the sole responsibility of the Subcontractor.

### **3.9 Miscellaneous Requirements**

- A. Layout of Work: The Subcontractor must layout its work from established base lines and bench marks indicated on the drawings, and will be responsible for all measurements in connection with the layout. The Subcontractor should furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the Work. The Subcontractor will be responsible for the execution of the Work to the lines and grades that may be established or indicated by the RE. The Subcontractor will also be responsible for maintaining and preserving all stakes and other marks established by the Contractor until authorized to remove them. If such marks are destroyed by the Subcontractor or through its negligence before their removal is authorized, the Contractor may replace them and deduct the expense of the replacement from any amounts due or to become due to the Subcontractor.

END OF SECTION 01 11 00



**SECTION 01 31 13**  
**PROJECT COORDINATION**

**PART 1 GENERAL**

**1.1 Section Includes**

- A. This section specifies requirements for requests for information as well as special and regularly scheduled progress meetings.

**1.2 Related Sections**

- A. General Conditions of the Contract; Section 01 11 00, Summary of Work; Section 01 32 00, Construction Progress Documentation; and Section 01 33 00, Submittal Procedures.

**1.3 Request for Information Procedures**

- A. Use Contractor's RFI Form. Contractor will provide sample forms at the Pre-Construction Meeting. Complete the form for any RFI and submit two copies of the RFI to the PM, and one copy to the SA.
- B. RFIs identifying a technical question relating to the design or construction of the project shall be submitted to the RE for disposition by the PM. Copies of the RFI are to be provided to the PM and SA in accordance with subparagraph 1.3 A. Attach drawings, sketches, and other clarifying documents along with recommended resolution if known. PM will respond and transmit Contractor's response to the RFI to the Subcontractor with copies to the RE and SA.
- C. If Subcontractor determines that Contractor's response to the RFI may impose a cost or a schedule impact on the Work, Subcontractor must inform the PM in writing with copies to the RE and SA within (3) working days from receipt. Subcontractor is not to proceed with any Work that incurs additional cost or time on the basis of an RFI. If no cost or schedule impact notification is received from Subcontractor within specified time, Subcontractor will be deemed to have accepted Contractor's response and responsibility for Work described therein.
- D. Subcontractor must maintain its own RFI log. The RFI number must be prefixed by Contractor assigned number followed by a dash followed by a sequential number starting at 001.

**1.4 Weekly Progress Meetings**

- A. Meetings with Subcontractor shall be held weekly with date, time and location to be specified by RE. The purpose of these meetings will be to conduct a joint review, review the quality of the on-going Work, and agree on project progress and subsequent submittals of updated and actual progress schedules.

**1.5 Pre-installation/Pre-work Meetings**

- A. When required in individual specification sections, convene a pre-installation meeting at Worksite before starting work requiring a written work plan. The purpose of the meeting will be to review the Subcontractor's work plan, determine acceptability of the Subcontractor's work plan, and provide authorization to proceed with the Work if the work plan is acceptable. Require attendance of parties directly affecting, or affected by, work of the specific section and RE. Notify the RE and PM as required by the Facility, but no less than two work days before the meeting.

**PART 2 PRODUCTS [Not Used]**

**PART 3 EXECUTION [Not Used]**

END OF SECTION 01 31 13

**SECTION 01 32 00  
CONSTRUCTION PROGRESS DOCUMENTATION**

**PART 1            GENERAL**

**1.1      Section includes**

- A. This section specifies requirements for scheduling and monthly progress reporting.

**1.2      Related Sections**

- A. General Conditions of the Contract Part I Section G, Section 01 11 00, Summary of Work;; Section 01 31 13, Project Coordination; and Section 01 33 00, Submittal Procedure.

**1.3      General Requirements for Construction Schedule**

- A. On a monthly basis Subcontractor must submit three copies of the updated Schedule to the PM. After all Subcontract Work items are complete, and as a condition of final payment, Subcontractor must submit three copies of an "As-built Contract Schedule" in same format as the Schedule showing actual start and finish dates for all Work activities and milestones, based on the accepted monthly updates.

Update the Schedule bi-weekly and provide copy to the PM and RE. Schedule updates must be the product of joint review meetings between the Subcontractor and RE. Enter actual progress on Schedule as agreed upon by the Contractor. If in the opinion of the Contractor the Subcontractor falls behind the approved Schedule, the Subcontractor must take steps necessary to improve its progress without additional cost to the Contractor.

**1.4      Monthly Progress Reporting**

- A. Monthly Schedule updates shall be the product of joint review meetings between the Subcontractor, the RE, and major active subcontractors. The joint review must focus on actual progress for the preceding month, planned progress for the upcoming month supported by a Subcontractor prepared 2- Week Look-ahead Schedule if required by the PM, impact to Schedule due to change notices issued, adverse weather, and any effected changes to the construction Schedule. The agreed upon progress and changes shall be incorporated in the Schedule update to be submitted. The update must always represent the actual history of accomplishment of all activities.
- B. The monthly Schedule update shall form the basis for the Subcontractor's progress payments. The progress payment for an activity must be based on its agreed upon percentage of completion. On unit priced subcontracts, the approval of the Subcontractor's monthly requisition is contingent on the submittal of a satisfactory monthly Schedule update, however, the basis of payment will be the actual measurement of Contractor accepted in place units of Work.

**PART 2            PRODUCTS            [NOT USED]**

**PART 3            EXECUTION            [NOT USED]**

END OF SECTION 01 32 00

**SECTION 01 32 10**  
**CONSTRUCTION PROGRESS DOCUMENTATION**

**PART 1 GENERAL**

**1.1 Summary**

- A. This section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work.

**1.2 Related Sections**

- A. Related Sections include the following: General Conditions of the Contract Part I Section G; Section 01 11 00, Summary of Work; Section 01 31 13, Project Coordination; and Section 01 33 00, Submittal Procedure.

**1.3 General Requirements for Construction Schedule**

- A. Prescheduling Conference: The Subcontractor and Contractor shall conduct a conference to review methods and procedures related to the Subcontractors Proposed Construction Schedule and Contractor's Preliminary Construction Schedule including the following:
  - 1. Review any software limitations and content and format for reports.
  - 2. Discuss constraints including **interim milestones and other factors that may impact the progress of the work.**
  - 3. Review delivery dates for Contractor Furnished Property or Government Furnished Property.
  - 4. Review schedule for work of any other separate contracts planned for the site.
  - 5. Review time required for review of submittals and resubmittals.
  - 6. Review requirements for tests and inspections by independent testing and inspecting agencies.
  - 7. Review time required for completion and startup procedures.
  - 8. Review and finalize list of construction activities to be included in schedule.
  - 9. Review submittal requirements and procedures.
  - 10. Review process for updating schedule.
- B. Coordination: Coordinate preparation and processing of schedules and reports with performance of construction activities, and scheduling and reporting of separate lower tier subcontractors. Coordinate the Subcontractor's Construction Schedule with the Schedule of Values, List of Lower Tier Subcontractors, Submittals Schedule, Progress Reports, Payment Requests, and any other required schedules and reports.
  - A. Secure time commitments for performing critical elements of the Work from parties involved.
  - B. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.
- C. Submitting Schedule Information: Subcontractor shall submit all schedule information electronically on the KSN website established for the project will be provided at the Kick-Off Meeting.

**PART 2 PRODUCTS**

**2.1 Submittals**

- A. Construction Related Submittals required to create a Construction Progress Schedule include the following:
  - 1. Submittal Schedule.
  - 2. Schedule of Values.
  - 3. Long Lead and Special Order Material and Equipment.
  - 4. List of Products including Test and Inspection.

5. List of Principal Suppliers and Fabricators.
6. Contractor or Government Furnished Property

## 2.2 Subcontractor's Submittal Schedule

- A. Submit a schedule of submittals, arranged in chronological order by dates required by the Contractor's Preliminary Construction Schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
- B. Coordinate Submittal Schedule with list of lower tier subcontractors, the Schedule of Values, and other Construction Related Submittals.
- C. At a minimum, arrange the following information in a tabular form in a format acceptable to the PM:
  1. Schedule date Scheduled date for each.
  2. Specification Section number and title.
  3. Submittal category (action or informational).
  4. Name of subcontractor.
  5. Description of the Work covered.
  6. Scheduled date for Contractor's final release or approval
- D. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

## 2.3 Subcontractor's Construction Schedule

- A. Time Frame: Extend schedule from date established for **the Notice to Proceed** to date of **Final Completion**.
  1. Subcontract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Subcontract Modification.
- B. Activities: Treat each area as a separate numbered activity for each principal element of the Work. Comply with the following:
  1. Activity Duration: Define activities so no activity is longer than **20** calendar days, unless specifically allowed by PM.
  2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
    - a. Structural Steel
    - b. Prefabricated roof and wall panels
    - c. HVAC Equipment
    - d. Electrical Equipment
  3. Submittal Review Time: Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule. Include review and resubmittal times.
  4. Startup and Testing Time: Include not less than one day for startup and testing.
  5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Contractor's administrative procedures necessary for certification of Substantial Completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected
  1. Phasing: Arrange list of activities on schedule by phase.
  2. Work under More Than One Contract: Include a separate activity for each contract.
  3. Work by FAA: Include a separate activity for each portion of the Work performed by FAA.

4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date. Delivery dates indicated stipulate the earliest possible delivery date.
  5. Contractor or Government Furnished Property: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary of Work." Delivery dates indicated stipulate the earliest possible delivery date.
  6. Work Restrictions: Show the effect of the following items on the schedule
    - a. Use of premises restrictions.
    - b. Seasonal variations.
    - c. Environmental control.
  7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    - a. Subcontract awards.
    - b. Submittals.
    - c. Purchases.
    - d. Mockups.
    - e. Fabrication.
    - f. Sample testing.
    - g. Deliveries.
    - h. Installation.
    - i. Tests and inspections.
    - j. Adjusting.
    - k. Curing.
    - l. Startup and placement into final use and operation.
  8. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
    - a. Structural completion.
    - b. Permanent space enclosure.
    - c. Completion of mechanical installation.
    - d. Completion of electrical installation.
    - e. Completion of access road and parking pavement
    - f. Substantial Completion
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion, **and the following interim milestones.**
1. Foundation and footings completion
  2. Structural steel erection completion
  3. Roofing and exterior walls installation completion
  4. Windows and doors installation completion
  5. Utilities connections – water supply, sewer, natural gas, and electrical power
  6. HVAC installation and Test & Balancing completions
  7. Electrical system installation completion and testing
  8. Furniture delivery and installation completion
  9. Break room appliances and cabinets installation completion
  10. Access road and parking paving completion
  11. Chain link fence and automatic gate installation
  12. Landscaping

- E. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Subcontractor's Construction Schedule within 14 calendar days of date established for **the Notice of Award**. Base schedule on the Preliminary Construction Schedule and whatever updating and feedback was received since the start of Project. Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
  - 1. For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in **10** percent increments within time bar.
- F. After all Subcontract Work items are complete, and as a condition of final payment, Subcontractor must submit an "As-built Contract Schedule" in same format as the Schedule showing actual start and finish dates for all Work activities and milestones, based on the accepted monthly updates.

## 2.4 Reports

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
  - 1. List of subcontractors at Project site.
  - 2. List of separate contractors at Project site.
  - 3. Approximate count of personnel at Project site.
  - 4. Equipment at Project site.
  - 5. Material deliveries.
  - 6. High and low temperatures and general weather conditions.
  - 7. Accidents.
  - 8. Meetings and significant decisions.
  - 9. Unusual events (refer to special reports).
  - 10. Stoppages, delays, shortages, and losses.
  - 11. Meter readings and similar recordings.
  - 12. Emergency procedures.
  - 13. Orders and requests of authorities having jurisdiction.
  - 14. Change Orders received and implemented
  - 15. **Construction** Change Directives received and implemented.
  - 16. Services connected and disconnected.
  - 17. Equipment or system tests and startups.
  - 18. Partial Completions and occupancies.
  - 19. Substantial Completions authorized.
- B. Material Location Reports: At **monthly** intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.
- C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents
- D. General: Submit special reports directly to FAA within **one** day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- E. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise FAA in advance when these events are known or predictable.

## PART 3 EXECUTION

### 3.1 Subcontractor's Construction Schedule

- A. Construction Schedule Submission: Subcontractor shall update its construction schedule **monthly**.
- B. Monthly Reviews: Monthly Schedule updates shall be the product of joint review meetings between the RE, PM, Subcontractor, and major active subcontractors. The joint review must focus on actual progress for the preceding month and planned progress for the upcoming month supported by a Subcontractor prepared **2-Week** Look-ahead Schedule. Impacts to Schedule due to change notices issued, adverse weather, and any other impacts to the construction Schedule including those based on items from paragraph 1.3A.
- C. Monthly Updates: The agreed upon progress and changes shall be incorporated in the Schedule update to be submitted. The update must always represent the actual history of accomplishment of all activities. If in the opinion of the Contractor the Subcontractor falls behind the approved Schedule, the Subcontractor must take immediate steps to improve its progress without additional cost to the Contractor.
- D. Progress Payments: The monthly Schedule update shall form the basis for the Subcontractor's progress payments. The progress payment for an activity must be based on its agreed upon percentage of completion. On unit priced subcontracts, the approval of the Subcontractor's monthly requisition is contingent on the submittal of a satisfactory monthly Schedule update, however, the basis of payment will be the actual measurement of Contractor accepted in place units of Work.

END OF SECTION 01 32 10

**SECTION 01 33 00  
SUBMITTAL PROCEDURES**

**PART 1           GENERAL**

**1.1     Section Includes**

- A. This section specifies requirements for providing submittals required under the Subcontract.

**1.2     Related Sections**

- A. General Conditions of the Contract; Section 01 32 00, Construction Progress Documentation; Section 01 45 00, Quality Control.

**1.3     Submittal Schedule**

- A. The Subcontractor is solely responsible for creating a Submittal Schedule identifying whether the submittals are samples, cut sheets, certified test results, and adding additional submittals as required by specifications, drawings or as recommended by a manufacturer. As applicable, the submittal schedule must state the action required for testing and inspection with the name of the persons authorized to review the submittal. The Subcontractor shall submit three copies of the Submittal Schedule to the PM for approval. The Subcontractor shall submit one copy electronically or three (3) copies of the Submittal Schedule for approval within 10 calendar days of Subcontract Award. At a minimum, the following submittal items must be provided to the Contractor for review and approval prior to installation:
1. Construction Progress Schedule.
  2. Schedule of Values.
  3. RMP
  4. Master Submittal List.
  5. Pre-Installation and Work Plans.
  6. Qualifications and Certifications of independent inspections and testing firms.

**1.4     Shop Drawings**

- A. Shop Drawings must be presented in a clear and thorough manner showing all details, construction sequence, dimensions, materials and work performed by other trades required to complete the construction related to the shop drawing submittal. Shop Drawings must contain the following information:
1. Date.
  2. Number of the drawing and revision.
  3. Name of project or facility.
  4. Name of Subcontractor and applicable lower tier subcontractor.
  5. Clear identity of contents and location of work.
  6. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
  7. Subcontractor's approval certifying it checked and coordinated the work of other trades.

**1.5     Warranties and Guarantees**

- A. Subcontractor must provide warranties/guarantees executed by the respective manufacturers, suppliers, and lower tier subcontractors for all installations as required in the Subcontract or as is customarily provided with the particular piece of equipment or system. All warranties are to be executed, in writing, for the benefit of the FAA. Subcontractor must enforce all warranties for the benefit of the FAA if so directed by the FAA or Contractor. In the event the Subcontractor's warranty has expired, the FAA may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty. Subcontractor must provide complete information for each item as follows:
1. Product or work item.
  2. Firm, with name of principal, address and telephone.
  3. Scope.
  4. Date of beginning of warranty.
  5. Duration of warranty.



6. Proper procedure to evoke the warranty in case of failure.
  7. Instances that might affect the validity of warranty.
  8. Subcontractor name or responsible principal, address and telephone number.
  9. Extended warranties normally provided by manufacturers that are beyond the warranty of construction shall be specifically noted.
- B. Equipment Warranty Tags. The Subcontractor must furnish and install equipment warranty tags on all Subcontractor furnished and installed equipment in accordance with the following:
1. Lettering shall be Arial bold, upper case, and easily readable.
  2. Tag shall be of a durable type material and of a type that can be written on.
  3. The tag shall state the following:
    - a. The title "Equipment Warranty".
    - b. Subcontractor's name and Subcontract Number.
    - c. Month-day-year (mm-dd-yy) the warranty expires.
    - d. Point of contact, including name and telephone number.
    - e. Manufacturer.

**PART 2            PRODUCTS            [NOT USED]**

**PART 3            EXECUTION**

**3.1            Submittal Submission Requirements**

- A. Four (4) complete sets, one (1) original and three (3) copies, of all shop drawings and/or submittal data shall be submitted for review and acceptance. One (1) set will be marked and returned to the Subcontractor. The Subcontractor must furnish two reproducible sets of shop drawings as finally approved. All submittals must be accompanied by dated transmittal letters identifying the contents of the submittals. Transmittal letters must consist of one original and one copy. Facsimile copies will not be accepted.
- B. The Subcontractor must ensure that all submittals are made with adequate time for review and acceptance, including re-submittals, so as not to delay the job. The Contractor will coordinate submittal review and return initial submittals within seven (7) calendar days and re-submittals within three (3) business days. **Work must not commence prior to acceptance of required submittals by Contractor.**
- C. Subcontractor must check and approve submittals prior to delivery to the Contractor. The Subcontractor is cautioned that the time period stipulated in this section does not include any allowance for re-submittal in cases where the PM determines that the Subcontractor's approval of the submittal is not adequately justified. Any delay caused by inadequacies in the Subcontractor's submittal will not entitle the Subcontractor to an extension of time or additional compensation. Lack of completeness or inadequate description will be justification for disapproval.

**3.2            Submittal Evaluation**

- A. The Contractor will evaluate all submittals requiring Contractor responsive action. The Subcontractor remains responsible for complying with Subcontract requirements, referenced standards, and regulations. The Contractor's evaluation will not relieve the Subcontractor of the responsibility for any error that may exist. Unsolicited submittals not required by the Contract Documents will be returned with the notation that the submittal is not required by the Subcontract and that the Contractor has not reviewed and has no comment on the submittal. The Contractor's evaluation will result in only one of four responses as follows:
  1. Approved: Work covered by the submittal may proceed provided Subcontractor complies with requirements of the Contract Documents.
  2. Approved as Noted: Work covered by the submittal may proceed contingent upon Subcontractor acceptance of the corrections and/or notations and provided Subcontractor complies with the requirements of the Contract Documents.
  3. Revise and Resubmit: Work covered by the submittal may not proceed until the submittal is revised in accordance with the corrections and/or notations and resubmitted.

4. Rejected: The submittal does not conform to the intent and requirements of the Contract Documents and the Subcontractor must resubmit.

END OF SECTION 01 33 00

**SECTION 01 35 26**  
**GOVERNMENTAL SAFETY REQUIREMENTS**

**PART 1           GENERAL**

**1.1       Section Includes**

- A. This section identifies some of the requirements of the OSHA Construction Standard.

**1.2       Related Sections**

- A. General Conditions of the Contract; Section 01 35 29, Health, Safety, And Emergency Response Procedures; and Section 01 35 13, Special Project Procedures.

**1.3       Subcontractor Responsibility**

- A. General Safety Provisions. The Subcontractor must bear full responsibility to provide safe working conditions for its employees and subcontractors. The Subcontractor must not permit any employee or subcontractor to work in surroundings or under working conditions that are unsanitary, hazardous, or dangerous to the health and safety of the employee.
- B. Accident Prevention. The Subcontractor must bear the responsibility of maintaining an accident prevention program such that frequent and regular inspections of the job site, materials and equipment are made by a competent person designated by the employer.
- C. Use of Equipment. The Subcontractor must not permit the use of any machinery, tool, material, or equipment that is not in compliance with OSHA regulations. The employer must permit only those employees qualified by training and/or experience to operate equipment and machinery.

**1.4       Contractor Responsibility**

- A. The Contractor will not be held responsible for safety inspections to assure Subcontractor conformance with the OSHA safety regulations. The Contractor, however, reserves the right to notify the Subcontractor of any deficiencies regarding worker safety.
- B. The Contractor will evaluate the Subcontractor on its safety performance, including that of its subcontractors. The number and severity of safety and security violations will be considered in this evaluation. Subcontractor safety violations are cause for termination for default, may result in notification of the Subcontractor's bonding company, and will affect the Subcontractor's opportunity to propose on future work. Failure to correct such deficiencies will result in the Contractor reporting such deficiencies to the FAA and may impact the Subcontractor's ability to work on future Contractor contracts.

**1.5       OSHA Regulations**

- A. The Subcontractor must comply with the latest Occupational Safety and Health Administration regulations (CFR 29 Part 1926) regarding safety in the work area.
- B. The Subcontractor must obtain copies of non-FAA referenced documents without additional cost to the FAA. If Subcontractor requests, a copy of FAA directives may be obtained by contacting the Subcontract Administrator.
- C. The Subcontractor is not relieved from adhering to other OSHA requirements not listed herein. The Subcontractor must consult the latest referenced OSHA documents for safety regulations.
- D. Documents.
  - 1. OSHA Documents:
    - CFR 29 Part 1926     Safety and Health Regulations for Construction
    - CFR 29 Part 1910    General Industry Standards Applicable to Construction Industry
  - 2. FAA Documents:
    - FAA Order 3900.49   Control of Hazardous Energy During Maintenance, Servicing and Repair

**PART 2                    PRODUCTS                    [NOT USED]**

**PART 3                    EXECUTION**

**3.1                    CFR 29 Part 1926 -- Safety and Health Regulations for Construction**

- A. This section contains a partial listing of the referenced OSHA standards. The Subcontractor is responsible for adhering to all applicable regulations including those not specifically referenced herein.
1. Subpart D (Occupational Health and Environmental Controls). Subcontractor must furnish adequate supply of potable water in containers clearly marked as potable water. Containers containing non-potable water must be clearly marked. Subcontractor must furnish toilet facilities based on the number of employees present on the job-site. A minimum of 1 facility is required for less than 20 employees. See CFR 29 Part 1926 Subpart D for complete requirements.
  2. Subpart E (Personal Protective Equipment). The Subcontractor must provide adequate protection for the head, hearing, and eyes for all employees working in an area where hazards to the head, ear and eyes exist. See CFR 29 Part 1926 Subpart E for complete requirements.
  3. Subpart I (Tools). All hand tools and power tools and similar equipment whether furnished by the Subcontractor or the employee must be maintained and operated in a safe condition. Personal protection must be used when applicable. The use of tools must be limited to the intended use of said tools. See CFR 29 Part 1926 Subpart I for complete requirements.
  4. Subpart K (Electrical). The Subcontractor must furnish ground fault protection for all electrical equipment used on the jobsite. Extension cords shall be three wire ground in good shape. Installation of the facilities will require energizing numerous circuits. The Subcontractor must protect against electrical shock by methods such as posting warning signs, supplying insulated gloves, locking out and tagging de-energized circuits, and other similar methods. See CFR 29 Part 1926 Subpart K for complete requirements.
  5. Subpart P (Excavation/Trenching). Prior to commencing trenching or excavation, the Subcontractor must ascertain that the area has been inspected for all utility lines and has been adequately marked. Trenches over four (4) feet in depth must require either adequate bracing or approved slope or bench methods. All trenches and excavations must be regularly checked for stability. In the event of a rain shower, the Subcontractor must suspend work activity within the trench or excavation until the stability of the trench or excavation is ascertained. See CFR 29 Part 1926 Subpart P and Division 2 of the Subcontract Specifications for complete requirements for additional requirements.

**3.2                    CFR 29 Part 1910 -- General Industry Standards Applicable to Construction Industry**

- A. This section contains a partial listing of the referenced OSHA standards. The Subcontractor is responsible for adhering to all applicable regulations including those not specifically referenced herein.
1. Section 1910.147. Subcontractor must maintain a written hazardous energy control procedure in accordance with CFR 29 1910.147. The written procedure must describe contractor's responsibilities regarding shift changes or personnel changes. A specific coordinated lockout/tagout procedure must be recorded in writing and signed by the Subcontractor and Subcontract Administrator with copies to each party.
  2. Section 1910.120. The Subcontractor must develop and implement an Emergency Response and Contingency Plan in accordance with OSHA Standard 29 CFR 1910.120. In the event of an emergency associated with remedial action, the Subcontractor must, without delay, take diligent action to remove or otherwise minimize the cause of the emergency; alert the Contractor; and institute whatever measures might be necessary to prevent any repetition of the conditions of actions leading to, or resulting in, the emergency. Emergency contact names and telephone numbers must be posted at all project phones and in site-support vehicles as well as included within the plan.

END OF SECTION 01 35 26

**SECTION 01 35 29**  
**HEALTH, SAFETY AND EMERGENCY RESPONSE PROCEDURES**

**PART 1           GENERAL**

**1.1 Section Includes**

- A. This section identifies Subcontractor requirements for work place safety and health as generally required by local, state, and Federal regulations.

**1.2 Related Sections**

- A. General Conditions of the Contract; Section 01 31 00, Project Coordination; Section 01 33 00, Submittal Procedures; Section 01 35 26, Governmental Safety Requirements.

**1.3 Subcontractor Responsibility**

- A. Subcontractor must comply with safety, health, and emergency response provisions of this Subcontract. The provisions of this section represent minimum requirements and shall not supersede additional requirements stated within the Subcontract or local, state, and Federal regulations.

**1.4 Personal Protection**

- A. The Subcontractor must provide all on-site personnel with appropriate personal safety equipment and protective clothing, and ensure that all safety equipment and protective clothing are kept clean and well maintained. Hard hats must be worn at all times from start to completion of the Subcontract unless a waiver is obtained in writing from the T4 Regional Program Manager. In addition, the following items shall be provided to and utilized by all personnel:
  - 1. Work clothing as dictated by the weather.
  - 2. Footwear appropriate for the job which may include steel-toe/shank work safety boots.
  - 3. Additional items shall be provided contingent on the type of hazard encountered and the accepted industry standard for handling the specific type of hazard.

**1.5 First Aid and Emergency Response Equipment**

- A. The Subcontractor must provide for appropriate emergency equipment including an industrial-type first aid kit, a 2A:20B:C-rated fire extinguisher, spill control equipment, and supplies of sufficient quantity to handle potential accidents/incidents related to the nature of the work being accomplished. A listing of emergency phone numbers and points of contact for fire, hospital, police, ambulance, and other appropriate emergency agencies shall be readily available.

**1.6 Notification of Spills and Discharges**

- A. Subcontractor must notify proper local authorities immediately in the event of a spill or discharge of potentially harmful or hazardous materials. Following notification of the local authorities, the Subcontractor shall notify the RE, PM, and Subcontract Administrator immediately. If the spill or discharge is reportable under local, state or Federal regulations, and/or human health or the environment is threatened, the Subcontractor shall notify the National Response Center at 1-800-424-8802 and the state's Department of Natural Resources where the spill or discharge occurred.
- B. Decontamination procedures may be required after clean-up to eliminate traces of the substance spill or reduce it to an acceptable level, as determined by the RE. Complete clean-up may require removal and disposal of contaminated soils. Personnel and equipment decontamination must occur as specified in this section. All contaminated materials, including solvents, cloth, soil, and wood, that cannot be decontaminated must be properly containerized, labeled, and properly disposed of as soon as possible.

Personnel and equipment that have come into contact with contaminated materials must be decontaminated. A detergent that has been shown to be successful and effective for removing the hazardous material must be used as the decontamination solution. Following washing, items shall be rinsed with clean water.

**1.7 Project-Generated Wastes**

- A. The Subcontractor must properly dispose of project-generated wastes that are or may have become contaminated (i.e., PCBs or asbestos). Such wastes include, but are not be limited to, disposable clothing, decontamination solvents, and decontamination wash waters.

**1.8 Confined Space**

- A. Definition. A confined space must be defined as a space, which, by design, has limited openings for entry and exit, unfavorable natural ventilation that could contain or produce dangerous air contaminants, and which is not intended for continuous employee occupancy. Confined spaces (as defined by OSHA) include, but are not limited to, storage tanks, compartments of ships, process vessels, pits, silos, vats, degreasers, reaction vessels, boilers, ventilation and exhaust ducts, sewers, tunnels, underground utility vaults, and pipelines.
- B. In general, FAA confined spaces include vaults, lift stations, crawl spaces, small engine generator rooms, sewers, sumps, chillers, pits, boilers, tunnels, manholes, cooling towers, tanks, and watershed.
- C. Applicable Documents. The following publications of the issue in effect on the date of the solicitation form a part of this specification and are applicable to the extent specified herein.
  - 1. American National Standards Institute (ANSI)  
2117.1 Safety Requirement for Confined Space
  - 2. FAA Orders  
FAA-C-1391D Installation and Splicing of Underground Cables  
FAA-C-1217G Electrical Work, Interior
  - 3. OSHA Standards  
29 CFR 1910.268 Telecommunications  
29 CFR 1910.269 Electric Power Transmissions, Generation, and Distribution  
29 CFR 1910.46 Permit-Required Confined Spaces  
29 CFR 1926.956 Underground Lines
- D. Requirements. Prior to any admittance into a confined space as defined in this Section, the Subcontractor must perform a hazard evaluation. The hazard evaluation shall include testing the atmosphere for oxygen content, the presence of toxic gases, and the presence of explosive or flammable gases.

**1.9 Underground Utility Damage Prevention**

- A. The Subcontractor is responsible for complying with all OSHA regulations related to underground utility damage prevention as further specified in Section 01 35 26. The Subcontractor should take all reasonable steps necessary to make certain that all active, abandoned, or unknown utilities are identified. Such steps are to include the utilization of an individual or firm acceptable to the Contractor and knowledgeable in Subsurface Utility Engineering (SUE) techniques, and competent to perform utility designation in conformance with the National Utility Locating Contractors Association (NULCA) Standard 101 for Professions Competence Standards for Locating Technicians or other written standard acceptable to the Contractor.

**PART 2 PRODUCTS [NOT USED]**

**PART 3 EXECUTION**

**3.1 Accident Reporting**

- A. In the event of an accident or incident, the Subcontractor must immediately notify the Contractor in accordance with the Subcontractor’s RMP. Within 2 working days of any reportable accident/incident or as otherwise set out within the RMP if an earlier time is specified, the Subcontractor must complete and submit to the Contractor a written Accident Report. This report must include the following information:
  - 1. Name, telephone, and location of entity.
  - 2. Project name and description.
  - 3. Name and title of person reporting.
  - 4. Location of accident/incident.
  - 5. Brief summary of the accident/incident giving pertinent details including type of operation ongoing at the time of the accident/incident.
  - 6. Cause of the accident/incident, if known.

7. Casualties (fatalities, disabling injuries).
8. Details of any existing hazard (chemical, contamination, work place safety).
9. Estimated property damage.
10. Nature of damage, effect on Subcontract schedule.
11. Action taken by Subcontractor to ensure safety and security.
12. Witness information/FAA personnel contacted.

### **3.2 Spills**

- A. In the event of a spill, the Subcontractor must take immediate action to control and contain the spill. This will include, at a minimum, the following actions:
  1. Keep unnecessary people away, isolate hazardous area, and deny entry.
  2. Do not allow anyone to touch spilled material.
  3. Stay upwind; keep out of low areas.
  4. Keep combustibles away from the spilled material
  5. Use water spray or foam to reduce vapor or dust generation, as needed
  6. Take samples for analysis to determine that clean-up is adequate. Properly trained personnel should be involved in this action.
  7. Take other appropriate actions as needed.
  8. For solid spills, immediately remove and place contaminated materials into staging piles and cover; identify the pile as contaminated; test the material for treatability; dispose of the contaminate off-site at an approved disposal facility.
  9. For liquid spills, immediately absorb with sand, clean fill, or other absorbent/spill mixture.

### **3.3 Permit-Required Confined-Space Program**

- A. Subcontractor shall be required to evaluate all potential confined spaces as contained in this project and shall submit a Permit Required Confined Space (PRCS) Program to the PM with a copy to the RE for review. The Contractor considers all confined spaces as permit required and therefore the Subcontractor must submit a PRCS Program for review. The PRCS Program must outline all potential confined spaces and shall be made in accordance with the applicable OSHA Standards. The PRCS Program shall be sent to the PM as a submittal with a copy to the RE and shall be in accordance with Section 01 33 00, Submittal Procedures of the Subcontract.
- B. Permits are required to enter all FAA confined spaces. The Subcontractor must prepare an application for permit that defines all conditions that must be met in order to ensure safety of personnel. Permits must be filled out, submitted, reviewed, and posted prior to any personnel entering the confined space. Subcontractor shall be required to permit all confined spaces. Prior to preparing the permit, the Subcontractor must obtain permission to permit the space from the Contractor. The Contractor will coordinate all applications with the FAA Systems Management Office (SMO) Confined Space Coordinator. See applicable OSHA Standards for additional information. At no time will the Subcontractor enter a FAA-owned confined space without first obtaining permission from the FAA through the Contractor.
- C. Copies of all confined space permits must be given to the RE and the SMO Confined Space Coordinator.
- D. Subcontractor must provide all test equipment, personal protective equipment and materials as required for the testing, permitting, monitoring and entering of confined spaces. All equipment must be calibrated within the last 6 months and shall be authorized for its intended use. Subcontractor must submit test equipment most recent calibration date to RE and the SMO Confined Space Coordinator on all test equipment used for confined spaces as part of its PRCS.
- E. Subcontractor must provide one set of all test equipment, personnel protective equipment and materials required for the RE. All items must be given to the RE at the beginning of the project. They will be returned when the project is complete. Subcontractor s must also include its PRCS Program adequate protection for the RE. The PRCS must include all ventilation, testing, monitoring, rescue equipment, ladders, and harnesses as required. All protection and testing for the RE shall be as required for all Subcontractor employees.
- F. All manholes and handholes greater than 3'-6" in depth shall be considered as permit-required confined spaces. Subcontractor shall adhere to all requirements as outlined herein.

### **3.4 Protection of Underground Utilities**

- A. Preparation

1. All existing underground utilities depicted on the drawings, (which include but are not limited to: power, control, and communications cables; telephone, water and sewer lines; and other utilities) are shown in their approximate locations only. Other utility lines may exist but not be depicted. It is the Subcontractor's responsibility to ensure that locations of all underground airport, FAA, public, and/or private utilities are established prior to work in the area.
  2. The Subcontractor must at its expense satisfactorily repair and/or pay the cost of repair for all damages to underground utilities that result from the Subcontractor's or its lower tier subcontractors' operations during the period of the Subcontract. The Subcontractor is responsible for completing any required repair work to any underground utility that is damaged by its workers, equipment, work, or subcontractors immediately, and with equal material approved by the RE.
  3. If the Subcontractor damages a cable that has been previously located, then the Subcontractor must repair the cable and, at its expense, install either a pull box or manhole depending on the type and/or size of the cable. The RE will determine whether a pull box or manhole is required. All costs related to the repair of the damaged cable will be the responsibility of the Subcontractor.
  4. Do not interrupt existing utilities serving facilities occupied by the Government or others except when permitted in writing by the RE and then only after acceptable temporary utility services have been provided. Provide a minimum 48-hours notice to the RE. Do not proceed with the interruption of any utility without written notice from the RE.
  5. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
  6. Protect subgrade and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary. Protect subgrade and foundation soils from softening and damage by rain or water accumulation.
  7. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- B. Pre-excavation Requirements for Underground Utility Installations.
1. Prior to any excavation, the Subcontractor must layout in the field the centerline of all proposed utilities. In addition the Subcontractor must white line (by white spray paint or other means acceptable to the RE) the limits of construction including the area(s) to be excavated. The Subcontractor must also identify the proposed placement of grounding rods and cathodic protection.
  2. The Subcontractor shall identify the location of existing underground utilities on as-built drawings, including any unknown or abandoned utility found during construction. The Subcontractor must ensure that all Airport officials, FAA technicians, other utility owners/operators, and any One-Call System performing utility designation/location services designate/mark existing utilities within the construction limits as well as the entire path of excavation, including five feet to either side of proposed utilities. The Subcontractor shall be solely responsible for notifying relevant utility owners/operators and One-Call System sufficiently in advance to ensure that delays to construction does not occur.
  3. After completion of the utility designation described above, the Subcontractor must hire a professional Subsurface Utility Engineering (SUE) or utility designation/locating company, acceptable to the RE, to designate and sweep the entire excavation area, including five feet to either side of proposed utilities, to confirm the locations of the marked utilities and identify and mark any additional unidentified utilities that may be within the limits of excavation.
  4. The Subcontractor, in accordance with Section 01 31 13, must notify the RE of the preferred date and time for a pre-work meeting for all excavation work. The RE will coordinate the pre-work meeting with utility owners, local Airport Authority, FAA, the Subcontractor, and others as applicable to walk the excavation area and review applicable documentation. The subcontractor must arrange to have its excavator and SUE (or designation firm) at the pre-work meeting. The Subcontractor must provide a written excavation work plan acceptable to the RE that includes a contingency plan to restore to service all utilities including cables that may be placed out of service or damaged during performance of the work. The work plan at a minimum must include:



- a. A list of qualified subcontractors such as plumber, electrician, fiber optical cable splicer, and others as applicable for emergency repair purposes. Due to current FAA/TSA/Airport security requirements, the Subcontractor shall ensure that these subcontractors have passed any airport security and registration requirement so they can be presented immediately at the job site when emergency repair is warranted.
  - b. The Subcontractor must coordinate with the RE to request an Emergency Procedures Plan from the Airport Authority or facility manager. This plan will outline special procedures during emergencies, disasters, accidents and injuries. The Subcontractor is to review the Emergency Procedures Plan with all its personnel prior to construction and every quarter thereafter.
  - c. The Subcontractor must investigate and provide a list of sketches/drawings to all disconnects to electrical circuits, jet fuel lines, natural gas, and main water sources that feed the services in the project area and its vicinity. All disconnects and shut-off valves shall be noted with special notation and procedures if required by the utility owners/operators.
  - d. Name of the SUE or utility designation firm including training and experience of the technician who will be performing the utility designation as well as equipment that will be used for sweeping the area to be excavated.
  - e. Name of the excavator including training and experience of the equipment operator who will be doing the work.
5. Subcontractor must expose all utilities that it will be crossing through non-destructive mechanical excavation methods such as vacuum excavation or similar mechanical method(s) approved by the RE (“potholing”) or by hand digging. When a cable is located, the Subcontractor must hand-excavate a trench five (5) feet each side of the exposed cable to verify that another cable is not adjacent to the exposed cable. All critical or high priority facilities must be exposed by potholing or hand digging every 100 feet (or less if on a curve) if the Subcontractor is working on or parallel to a critical or high priority utility. All exposed utilities must be properly supported and protected during construction.
  6. Subcontractor must continuously maintain utilities, facilities and/or systems that are or may be affected by work associated with the project. The Subcontractor shall provide the RE with written reports on any cable cuts in accordance with Subsection 3.2 C. below.
  7. If the Subcontractor does not find an underground utility that was previously marked, the excavation must be stopped, the RE must be notified, and the Subcontractor must contact the appropriate owner/operator of the utility or make contact with the appropriate owner/operator, using the One-Call System when warranted.
  8. Every attempt shall be made to preserve the locate markings during excavation. Locate markings that are no longer visible must be refreshed by calling the one-call system and/or the utility owners/operators for remarking.
  9. All existing utilities that have been exposed during exploratory potholing or excavation must be supported to prevent stretching, kinking, or damage to the existing utility.

C. Excavation

1. Preserve, protect and maintain existing operable drains, sewers, and electrical ducts during grading, excavating and backfilling operations. Keep excavations dry. Locations indicated for existing utility facilities are approximate. Pipes or other manmade obstructions, in addition to those indicated, may be encountered. Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Subcontractor’s risk. Perform all work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility owner. Excavation made with power driven equipment is not permitted within five feet of any known existing utility. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered. Support uncovered lines until approval for backfill is granted by the RE. No excavated material shall be disposed of in such a manner as to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.
2. An observer, acceptable to the RE, must be present to assist the equipment operator when operating equipment around known underground facilities and utilities. Adhere to the following during excavation:

- a. All mechanized excavation shall start with 6 to 10 inches excavation on the surface. The equipment operator must immediately cease operation and notify the RE if utility warning tapes, sand, or bedding material is uncovered at any time during excavation.
  - b. All excavations within 5 feet of any pedestal, closure, riser guard, pole (with riser), meter, or other structure must be performed by hand digging or other means such as vacuum excavating.
  - c. If the Subcontractor discovers damage, causes damage, or even contacts an existing underground utility, the owner/operator of that utility, and RE must be notified immediately. The Subcontractor will be responsible for making necessary repair and/or replacement in accordance with this section and the terms and conditions of the Subcontract.
  - d. If there is a critical or high priority utility line in the dig area, make arrangements for the utility owner/operator to be on the job site during the excavation. If the utility owner/operator refuses to be present, document this response by appending it to the request form.
  - e. Only those subcontractor employees qualified by training, licensed or experienced (as appropriate) shall be permitted to operate machinery, tools or equipment.
3. The Subcontractor and RE must coordinate on a daily basis with the excavator and the excavating work crew regarding the work to be performed that day with an emphasis on the excavation work plan and anticipated utility crossings.

END OF SECTION 01 35 29

**SECTION 01 45 00**  
**QUALITY CONTROL**

**PART 1        GENERAL**

**1.1        Section Includes**

- A. This section specifies requirements for quality control of the Work including, but not limited to, certificates of compliance, inspections and testing by the Subcontractor, and surveillance by the Contractor.

**1.2        Related Sections**

- A. General Conditions of the Contract Part I Section E and Section G; Section 01 11 00, Summary of Work; Section 01 32 00, Construction Progress Documentation; Section 01 33 00, Submittal Procedures; and Section 01 77 00, Closeout Procedures.

**1.3        Subcontractor's Risk Management Plan**

- A. Subcontractor's RMP must identify Subcontract quality requirements for each activity and describe how Subcontractor intends to furnish control testing, certifications, and records in order to provide quality Work. The RMP must include procedures verifying equipment, workmanship, fabrication, construction, operations, and inspections comply with the Contract Documents. Minimum RMP requirements are as follows:
  - 1. Name, resume, authority, and responsibility of QC Representative responsible for monitoring the quality of construction activities.
  - 2. List of outside organizations including testing laboratories, architects, or consulting engineers that will be employed by the Subcontractor. Include a description of services to be provided.
  - 3. List of definable features of work that have distinct and separate control requirements.
  - 4. An inspection and test plan keyed to the construction schedule, following the order of the specification technical sections, indicating which inspections and tests will be performed, the names of persons responsible for the inspection and testing of each segment of work, and the time schedule and frequency for each inspection and test.
  - 7. Subcontractor's procedure by which to identify, segregate, disposition, and correct nonconforming product and services.
  - 8. Subcontractor's procedure for initiating requests, control, and implementation of changes to the Subcontract's scope of work, specifications, or requirements.
- B. The Subcontractor's RMP must address the 4-step inspection process for each definable feature of work (DFOW) that includes: preparatory inspections, initial inspections, follow-up inspections, and final inspections. Minimum requirements are as follows:
  - 1. Subcontractor must develop checklists to document the 4-step inspection process for each DFOW
  - 2. A copy of the completed checklists must be posted on the Contractor provided website on a weekly basis. If no access is available, access will be given to the PM or RE.

**1.4        Contractor Quality Monitoring**

- A. Contractor may perform such inspections, test, and monitoring as necessary to determine or verify Subcontractor's compliance with Subcontract requirements. Subcontractor must provide such facilities and assistance for Contractor monitoring as may be reasonably required and must ensure that all quality control records and places of Work are open and available to Contractor. Contractor's monitoring activities may consist of review, observation, inspection of Subcontractor personnel, material, equipment, processes, and test results including off-site inspections. Contractor may perform quality audits of records and performance of Subcontractor or its lower tier subcontractor and suppliers. The Subcontractor, lower tier subcontractor or supplier being audited must be available during the audit as required by the Contractor. Testing or inspecting by the Contractor or FAA does not relieve the Subcontractor or its subcontractors from performing Work according to Subcontract requirements.

- B. The PM or RE will notify Subcontractor of any detected non-compliance with the requirements of this Section or other technical specification sections. Such notice, when delivered to Subcontractor at the Work site, shall be deemed sufficient for the purpose of notification. Subcontractor must take immediate corrective action after receipt of a non-compliance notice and maintain a detailed record of every non-compliance and corrective action taken. The Subcontractor must make no part of time lost due to non-compliance and/or stop orders the subject of a request for extension of time or compensation. Cost incurred by Contractor or FAA to correct defective work will be deducted from the total amount due the Subcontractor.

**PART 2            PRODUCTS            [NOT USED]**

**PART 3            EXECUTION**

**3.1            Quality Reports**

Subcontractor must provide forms to be used in conjunction with RMP reporting. A copy of all forms must be included with the RMP. The following requirements are listed for specific reports:

- A. Test Reports. Subcontractor must be responsible for establishing a system that will record all tests results. Information on test designation, location, date of test, specification requirements, results and retest results, causes for rejection and recommended remedial actions shall be documented. A copy of test results must be sent directly from the agency performing the testing services to PM or RE. A copy of any failing report must be sent immediately. All test reports provided by a testing agency must be reviewed and signed by a competent, qualified individual in the related discipline of the test subject matter.
- B. Construction reports. Subcontractor must submit duplicate copies to RE by 9:00 a.m. on the business day following day of report. At a minimum, daily construction reports must include **the following information:**
1. List of subcontractors at the site.
  2. List of separate contractors at the site.
  3. Approximate count of personnel at the site.
  4. High and low temperatures, general weather conditions.
  5. Accidents.
  6. Meetings and significant decisions.
  7. Unusual events.
  8. Stoppages, delays, shortages, losses.
  9. Meter readings and similar recordings.
  10. Emergency procedures.
  11. Orders and requests of governing authorities.
  12. Change Orders received, implemented.
  13. Services connected, disconnected.
  14. Equipment or system tests and start-ups.
  15. Partial Completions/Occupancies.
  16. Substantial Completions authorized.
  17. Number of days used in the Subcontract period to date.

**3.2            Record Drawings.**

The QC Representative shall ensure the Record Drawings required by the Subcontract are scalable, kept current on a daily basis, and marked to show deviations from the Contract drawings. QC Representative must ensure each deviation has been identified with appropriate modifying documentation.

### 3.3 Inspections and Testing Laboratory

All inspections and testing on and off Site required by the Subcontract must be performed as specified in individual specification sections by a certified independent firm employed by the Subcontractor at Subcontractor's expense. Inspecting, testing, and source quality control may occur on or off the Site. Subcontractor must submit qualifications and certifications of the independent inspections and testing firm for Contractor approval. Subcontractor must submit testing reports by the independent firm to the PM and RE, in duplicate, indicating observations and results of tests and indicating compliance or noncompliance with Contract Documents. Subcontractor must furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested. Any retesting required because of nonconformance to specified requirements must be performed by the same independent firm at Subcontractor's expense.

END OF SECTION 01 45 00

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

**PART 1           GENERAL**

**1.1       Section Includes**

- A. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.

**1.2       Related Sections**

- A. Section 01 11 00, Summary of Work; Section 01 45 00, Quality Control.

**1.3       Temporary Utilities and Support Facilities**

- A. Temporary utilities required include but are not limited to:
  - 1. Water service and distribution.
  - 2. Electric power and light.
  - 3. Telephone service.
  - 4. Storm and sanitary sewer.
- B. Temporary construction and support facilities required include but are not limited to:
  - 1. Temporary heat.
  - 2. Field offices and storage sheds.
  - 3. Temporary roads and paving.
  - 4. Sanitary facilities, including drinking water.
  - 5. Temporary enclosures.
  - 6. Temporary Project identification signs and bulletin boards.
  - 7. Waste disposal services.
  - 8. Rodent and pest control.
  - 9. Construction aids and miscellaneous services and facilities.
  - 10. RE Trailer.
- C. Security and protection facilities required include but are not limited to:
  - 1. Enclosure fence for the site.

**1.4       Contractor Responsibilities**

- A. Contractor shall make all reasonable required amounts of utilities available to the Subcontractor from existing outlets and supplies to the extent allowed by the Government. Unless otherwise provided in the Subcontract, the amount of each utility service consumed shall be charged to or paid for by the Subcontractor at prevailing rates charged to the Government or at reasonable rates determined by the Contractor. The Subcontractor must carefully conserve any utilities furnished without charge.
- B. The Subcontractor, at its expense and in a workmanlike manner satisfactory to the Contractor must install and maintain all necessary temporary connections and distribution lines and all meters required to measure the amount of each utility used. Prior to final acceptance of the work by Contractor, the Subcontractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

**1.5       Subcontractor Responsibilities**

- A. The Subcontractor must confine all operations (including storage of materials) to areas set out in the Subcontract or otherwise authorized or approved by the Contractor.
- B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Subcontractor only with the approval of the PM, and must be built with labor and materials furnished by the Subcontractor without expense to Contractor. The temporary buildings and utilities shall remain the property of the Subcontractor and must be removed by the Subcontractor at its expense upon completion of the Work. With the written consent of the SA, the buildings and utilities may be abandoned and need not be removed.
- C. The Subcontractor must use only established roadways, or when authorized by the Contractor, temporary roadways that may be constructed by the Subcontractor at the Subcontractor expense. When materials are transported in prosecuting the Work, vehicles must not be loaded beyond the loading capacity of the vehicle or as

prescribed by any laws or regulation. When it becomes necessary to cross curbs or sidewalks, the Subcontractor must protect them from damage; and must repair or pay for the repair of any damaged curbs, sidewalks, or roads.

#### **1.6 Temporary Utility Installation**

- A. The Subcontractor must provide, maintain, and remove temporary electrical power, drinking and project water, and sanitary facilities as necessary for the proper and expeditious execution of work. If these facilities are not available on-site for use by the Subcontractor, then these facilities must be installed and maintained to comply with all federal, state, and local regulations governing such installations.
- B. Locations of such facilities will be approved by the RE.
- C. Subcontractor must provide and pay for all temporary services and facilities as specified herein and as necessary for the proper and expeditious execution of the Work.
- D. Subcontractor must make, or have made all connections to existing services and sources of supply as necessary and/or indicated and pay all charges for same.
- E. Subcontractor must provide all labor, materials, equipment and appurtenances necessary for the complete installation, operation and maintenance of all temporary service systems and facilities.
- F. All Work under this Section must comply with applicable laws, rules, regulations, codes, ordinances and orders of all federal, state and local authorities having jurisdiction for the safety of persons, materials, and property.

#### **1.7 Temporary Water**

- A. Subcontractor must make arrangements to transport all necessary water for construction and drinking purposes in accordance with CFR 29 Part 1926, Subpart D.

#### **1.8 Temporary Toilets and Sanitation**

- A. Subcontractor must provide ample and suitable on-site sanitary conveniences with proper enclosures and hand washing facilities in accordance with CFR Part 1926, Subpart D for the use of the workers employed on the Work. Temporary toilets must be properly maintained and serviced on a regular basis. Secure temporary toilets to prevent possible overturning.

#### **1.9 Temporary Electric Lighting and Power**

- A. Subcontractor must provide and maintain a temporary lighting and power system in accordance with CFR 29 Part 1926 Subpart K for construction and inspection purposes.
- B. Subcontractor must make all necessary arrangements for temporary electrical services with the local power company to provide and pay for all temporary work or, at Subcontractor's option, provide an approved temporary engine generator at the project site for construction support.

#### **1.10 Temporary Heat**

- A. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
- B. Maintain minimum 50 degree F ambient temperature in enclosed areas where construction is in progress.

#### **1.11 Temporary On-Site Communications**

- A. The Subcontractor may provide on-site communications with hand-held radios. Coordinate with the PM or RE and verify frequencies used do not interfere with local operations.

#### **1.12 Temporary Access**

- A. The Subcontractor must provide, maintain, and remove temporary roads necessary for access to the Worksites. These access roads must be obliterated at the conclusion of the work and the areas must be protected against erosion and shall be reseeded.
- B. Work must be done in accordance with the Project Specifications and drawings.
- C. The Subcontractor must take all precautions necessary to protect the existing facilities, equipment, buildings, vegetation, etc., during construction. Any areas damaged must be repaired or replaced at no additional cost to Owner.
- D. All repairs must match the original finish and be made utilizing materials equal in quality to the existing.
- E. Repairs must be approved by the RE or PM and Airport Authority.

- F. No separate payment will be made for temporary access.

### **1.13 Barricades, Warning Signs, and Hazard Markings**

- A. Subcontractor must furnish, erect and maintain all barricades, warning signs and markings for hazards to protect the Work.
- B. When used during peak periods of darkness, such barricades, warning signs and hazard markings must be suitably illuminated (open flame type lights are not permitted).
- C. Once erected, Subcontractor must maintain barricades, warning signs and markings for hazards until their dismantling is directed by the RE or PM.

### **1.14 Temporary Construction Support Facilities**

- A. Provide Contractor Field Office in accordance with this Section. Maintain temporary construction and support facilities until there is no need for them or at project completion. Remove all temporary facilities as directed by the RE.
- B. Provide incombustible construction for offices, shops and sheds located within the construction area, or within 30 feet of building lines. Comply with requirements of NFPA 241.
- C. Temporary HVAC. The Subcontractor must provide and be responsible for all temporary heat and ventilation. Provide temporary heat required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy. Where natural ventilation of work in progress is not sufficient for proper workmanship, provide power ventilators in conjunction with openings in work. Provide and operate either exhaust or supply fans/blowers, or both, sufficient to ventilate work adequately.
- D. Heating Facilities. Except where use of the permanent system is authorized, provide vented self-contained LP gas or fuel oil heaters with individual space thermostatic control. Use of gasoline-burning space heaters, open flame, or salamander type heating units is prohibited.
- E. Temporary Buildings. All temporary buildings provided by the Subcontractor must be weather and watertight, and must be maintained in a neat orderly appearance for the duration of the work, and must be provided with raised wood floors, solid-sheathed composition roofs, adequately screened windows for light and ventilation and substantial wood doors with provisions for locking.

### **1.15 RE Field Office Description**

- A. This item must consist of furnishing, maintaining and weekly cleaning of a new field office for the exclusive use of the RE, a weather-proof building or buildings hereafter described, at locations approved by the RE. Unless otherwise approved, the buildings must be independent of any buildings used by the Subcontractor and all keys to the buildings must be turned over to the RE. The RE will designate the location of the building and it shall remain on the Worksite until released by the RE. (New mobile units may be substituted with the approval of the RE).
- B. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access.
- C. Field offices must have a ceiling height of not less than seven feet (7'), and a floor space of not less than four hundred (400) square feet. The office must be provided with sufficient heat, natural and artificial light, and air conditioning. Doors and windows shall be equipped with locks approved by the RE. Suitable sanitary facilities separate from those for the Subcontractor's personnel meeting Federal, State and Local Health Department requirements must be provided and maintained clean and in good working condition and must be stocked with lavatory and sanitary supplies at all times during the period of the Subcontract.
- D. In addition, the following equipment and furniture meeting the approval of the RE must be furnished:
  - 1. 2 desks and chairs.
  - 2. 1 drafting table and stool.
  - 3. 2 file cabinets, letter size, 4 drawer with independent locks.
  - 4. 6 chairs.



5. 1 equipment cabinet with lock.
  6. 2 computer and printer stands.
  7. 1 carbon dioxide fire extinguisher (10 lb. rated capacity).
  8. 1 electric water cooler dispenser w/water supplied as needed.
  9. 1 telephone, with a local exchange.
  10. 1 Plan rack.
  11. 1 six shelf bookcase.
  12. 1 trash can.
- E. Remove field office when no longer required by the RE, but not prior to 30 days after completion of punchlist item construction work.
- F. The Subcontractor must make arrangements for and pay for, at a minimum, the following utilities:
1. Temporary electric power and light.
  2. Telephone service.
- G. All utilities must be functioning within 15 days of the date established for commencement of the work. The Subcontractor must arrange for the RE to inspect and test each temporary utility before use. Coordinate with the RE requirements for certifications and permits. The Subcontractor must engage the appropriate utility owner to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendation. All work associated with utilities owned by the Government must be performed by the Subcontractor as approved by the Contractor.
- H. This item must be counted as one lump sum for provision of a field office in accordance with this specification. Payment for providing the field office fully equipped as specified shall be made at the Subcontract Fixed Price. The Subcontractor must make payment for all long distance phone calls made by its employees and subcontractors.

**PART 2            PRODUCTS    [NOT USED]**

**PART 3            EXECUTION   [NOT USED]**

END OF SECTION 01 50 00

**SECTION 01 60 00**  
**PRODUCT REQUIREMENTS**

**PART 1 GENERAL**

**1.1 Section Includes**

- A. This section covers Subcontractor's requirements regarding materials and equipment that are incorporated into the Work.

**1.2 Related Sections**

- A. General Conditions of the Contract; Section 01 11 00, Summary of Work; Section 01 45 00, Quality Control, and other Specification Sections as may apply to this section.

**1.3 Materials and Equipment Incorporated into Work**

- A. Material and equipment incorporated into the Work must conform to applicable specifications and standards and must comply with size, make, type and quality specified, or as specifically approved in writing by the PM. Manufactured and fabricated products must be designed, fabricated and assembled in accordance with the best and current engineering and shop practices. Like parts of duplicate units must be manufactured to standard sizes and gauges and must be interchangeable. Two or more items of the same kind must be identical and manufactured by the same manufacturer.
- B. Products must be suitable for service conditions. Equipment capacities, sizes and dimensions shown or specified must be adhered to unless variations are specifically approved in writing. Do not use material or equipment for any purpose other than for which it is designed or specified. Furnish and install products specified. Other makes or brands may be used as outlined under options and conditions for substitution stated in this section.

**1.4 Manufacturer's Instructions**

- A. When Contract Documents require that installation of Work shall comply with manufacturer's printed instructions, copies of such instructions must be distributed to parties involved in the installation including the RE with copies to the PM. The Subcontractor must maintain one set of complete instructions at the Worksite during installation and until completion.
- B. Products must be handled, installed, connected, cleaned and conditioned in strict accordance with such instructions and in conformity with specified requirements. If job conditions or specified requirements conflict with manufacturer's instructions, the Subcontractor must consult with the RE for further instructions. All work must be performed in accordance with manufacturer's instructions. No preparatory step or installation procedure shall be omitted unless specifically modified or exempted by contract documents.

**1.5 Transportation and Handling**

- A. Products must be delivered in undamaged condition, in manufacturer's original containers or packing, with identifying labels intact and legible. Shipments must be inspected to ensure compliance with requirements of the Contract Documents and approved submittals. Ensure that products are properly protected and undamaged immediately on delivery. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packing.
- B. Delivery of Subcontractor-Furnished Materials. The Subcontractor must have personnel at the project site to receive all material being shipped by delivery vehicles. Contractor or FAA personnel are not responsible for signing off on deliveries of Subcontractor-Furnished Material. Delivery of Subcontractor-furnished material shall not be accepted by any Federal Government personnel.

**1.6 Storage [NOT USED]**

**1.7 Proprietary Names**

- A. Whenever proprietary names are used in this specification for material or equipment, such names must be construed as a standard to establish quality and accurately define the material or equipment. Another make or item

may be approved provided it is equal or better than the specified manufacturer. All materials and equipment that is Subcontractor furnished material must meet or exceed the specified salient characteristics.

**1.8 Substitutions**

- A. A separate request for each substitution must be submitted. Each request must be supported with complete data substantiating compliance of proposed substitution with the requirements stated in the Contract documents. Each request must include product identification, manufacturer's literature including address, product description, reference standards and performance, and test data. Samples must be submitted as applicable.
- B. Substitution Information. An itemized comparison of the proposed substitution with the product specified must be included. The following information must also be included: data relating to changes in the construction schedule; list of changes required in other work or products; and accurate cost data.
- C. Substitution Conditions. Substitute products must not be ordered or installed without written acceptance from the PM. In making a formal request for substitution, the Subcontractor represents that it has investigated the proposed product and has determined that it is equal to or superior in all respects to that specified; that they will provide same warranties or bonds for substitutions as for product specified, that they will coordinate installation of accepted substitution into work to be complete in all respects, that they waive claims for additional costs caused by substitution that may subsequently become apparent, and that cost data is complete and includes related costs under this Subcontract.

**1.9 Material Safety Data Sheets**

- A. The Subcontractor must submit Safety Data Sheets (SDS), Department of Labor Form OSHA-174, as prescribed in Federal Standard No. 313, latest edition, for hazardous material five (5) days before delivery of the material, whether or not listed in Appendix A of the Standard. This obligation applies to all materials delivered under this contract which will involve exposure to hazardous materials or items containing these materials. "Hazardous Materials", as used in this paragraph, is as defined in Federal Standard No. 313, latest edition.
- B. SDS Submittal. The RE, during construction, will routinely check products utilized on site by the Subcontractor to ensure SDSs have been submitted and approved, in accordance with Section 01 33 00, Submittal Procedures. If the Subcontractor does not submit the required information as described herein, the Contractor, at its option, will have a complete project survey performed by a qualified testing firm prior to acceptance of the project from the Subcontractor. The Subcontractor must bear the cost of all surveys and any subsequent removal/replacement of asbestos-containing materials.

**1.10 Asbestos-Free and Lead-Free Materials**

- A. The Subcontractor must provide to the SA a signed statement stating that to the best of its knowledge, no asbestos-containing or lead-containing materials were used during the construction of this project. If the Contractor suspects the presence of asbestos, the Contractor will sample the suspect material to verify that no asbestos-containing material was utilized. If asbestos-containing material is subsequently found during sampling of the materials, the Subcontractor must remove and replace the product or material at its expense. In addition, the Subcontractor must incur the costs of the original testing and/or any retesting that may be necessary.

<b>PART 2</b>	<b>PRODUCTS</b>	<b>[NOT USED]</b>
<b>PART 3</b>	<b>EXECUTION</b>	<b>[NOT USED]</b>

**END OF SECTION 01 60 00**

**SECTION 01 71 33**  
**PROTECTION OF ADJACENT CONSTRUCTION**

**PART 1           GENERAL**

**1.1 Section Includes**

- A. This section the basic care the Subcontractor must use to prevent unnecessary damage to property in or near the Worksite during performance of the Work.

**1.2 Related Sections**

- A. Section 01 11 00, Summary of Work; and Section 01 50 00, Temporary Facilities and Controls.

**1.3 Protection of Existing Vegetation, Structures, Equipment, and Facilities**

- A. The Subcontractor must take all precautions necessary to protect the existing facilities, equipment, buildings, and vegetation during construction. Any areas damaged must be repaired or replaced at no additional cost to owner. Repairs must be approved by the RE. All repairs must match the original finish and be made utilizing materials equal in quality to the existing.
- B. The Subcontractor must preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which is not to be removed and which does not unreasonably interfere with the work required under this contract. The Subcontractor shall only remove trees when specifically authorized to do so, and must avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during Subcontract performance, or by the careless operation of equipment, or by workmen, the Subcontractor must trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the RE.
- C. The Subcontractor must protect from damage all existing improvements and utilities at or near the Worksite and on adjacent property of a third party, the locations of which are made known to or should be known by the Subcontractor.
- D. The Subcontractor must repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this Subcontract or failure to exercise reasonable care in performing the Work. If the Subcontractor fails or refuses to repair the damage promptly, the Contractor may have the necessary work performed and charge the cost to the Subcontractor

**1.4 Property Protection**

- A. The Subcontractor must construct and maintain such temporary fences, gates and other facilities as shall be necessary for preservation of crops, control of livestock, and protection of property. Before cutting a fence, the Subcontractor must take necessary precautions to prevent the straying of livestock and may prevent the loss of tension in or damage to adjacent portions of the fence. The Subcontractor must immediately replace all fencing and gates that it cuts, removes, damages, or destroys with new materials to the original standard, with the exception that undamaged gates shall be reused.
- B. The Subcontractor must comply with the request of the property owner relative to leaving gates open or closed.
- C. The Subcontractor must use all necessary precautions to avoid the destruction of surveying markers such as section corners, witness trees, property corners, mining claim markers, bench markers, triangulation stations, and the like. If any such marker must be destroyed, the Subcontractor must first notify the agency responsible for the marker, as well as the RE, and assume all responsibility for replacing markers.
- D. Unnecessary damage is that which can be avoided through efficient and careful performance of the work in a careful manner, taking into account the land rights which have been secured. If the Subcontractor damages any property, the Subcontractor must at once notify the RE and owner or custodian and may make or arrange to make prompt and full restitution.
- E. Maps and specifications provided by Contractor may not give the location of all water supply, drainage, irrigation, and other underground facilities. Prior to entering a tract of land for subcontract purposes, the Subcontractor must ascertain from the property owner or other reasonably available source the location of any irrigation system, domestic water system, source of water, and drainage system existing on the property, whether serving that

property or other property. The Subcontractor must report any findings to the RE. The Subcontractor must avoid damaging or obstructing these facilities or polluting water supplies.

- F. The Subcontractor must hold Contractor harmless from any and all suits, actions, and claims for damages, including environmental impairment, to property arising from any act or omission of the Subcontractor, its subcontractors, or any employee of the Subcontractor or subcontractors, in any way related to the Work or operations under this Subcontract.
- G. The Subcontractor must indemnify and hold harmless the property owners or parties lawfully in possession against all claims or liabilities asserted by third parties, including all governmental agencies, resulting directly or indirectly from the Subcontractor's wrongful or negligent acts or omissions.
- H. The Subcontractor must maintain all roads used by it, and upon completion of the job must leave them in as good a condition as when first used. A road-grading machine, not a bulldozer, must be used for maintenance and final grading. In no event shall the Subcontractor interfere with the property owner's use of roads existing prior to the Subcontractor's entry.

### **1.5 Management and Disposal of Hazardous Wastes**

- A. The management and disposal of hazardous wastes and materials exposes the Subcontractor, Contractor, and FAA to short and long-term liabilities. In order to reduce these potential liabilities it is critical that the Subcontractor be fully aware of the hazards and regulatory requirements associated with the hazardous materials involved in this project. Only qualified personnel must be used in their handling and transportation. Before commencing work, the Subcontractor must:
  - 1. Perform an environmental assessment of the work required under the contract identifying tasks which involve the use, handling or transportation of hazardous materials or wastes.
  - 2. Submit an environmental plan identifying and dealing with each specific task involving the wastes. The plan must be specific enough to demonstrate a thorough understanding of the environmental risks and the appropriate methodology for dealing with them. The plan must also list the required permits and reference the relevant regulations which govern the activities involved in dealing with the materials or wastes.
  - 3. Meet with representatives of the Contractor during the preconstruction conference to discuss and to develop a mutual understanding on implementation of the plan.
  - 4. The Contractor may require other tasks to be added to the plan. If planned methodologies for dealing with the risks are deemed insufficient, the PM may require revision. Work involving hazardous materials or wastes shall not commence until adequate plans have been submitted and reviewed. Contractor's review of the Subcontractor's plan shall in no way relieve the Subcontractor of its liability for environmental law and regulatory compliance.

### **1.6 Protection of Installed Work**

- A. Protect installed Work. Provide special protection where required in the Specifications and drawings or under manufacturer's warranty.
- B. Provide temporary and removable protection for installed Products. Control activities in immediate Work area to prevent damage.
- C. Protect finished floors and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- D. Prohibit traffic or storage upon completed surfaces. Obtain protection instructions from the manufacturer if traffic or activity is necessary.

**PART 2            PRODUCTS            [NOT USED]**

**PART 3            EXECUTION            [NOT USED]**

**END OF SECTION 01 71 33**

**SECTION 01 74 00  
CLEANING AND WASTE MANAGEMENT**

**PART 1           GENERAL**

**1.1     Section Includes**

- A. This section sets out the basic Subcontractor requirements for maintaining an orderly and clean Worksite.

**1.2     Basic Requirements**

- A. The Worksite, including storage areas, shall be kept clean and orderly during progress of the Work. The Subcontractor will be personally responsible for the storage of tools and materials. The Subcontractor must and must require each subcontractor engaged upon the work to bear full responsibility for cleaning up during and immediately upon completion of their work.
- B. The Subcontractor must provide on-site containers for the collection of waste material, debris and rubbish and periodically remove as required or at the direction of the RE. Any spillage on access or haul routes shall be cleaned up immediately. All spoil, waste, or debris removed from the work site and not specified for reuse or identified as salvageable items, shall become the property of the Subcontractor and must be disposed of off site in areas authorized by the applicable County, State and/or Local agencies and in accordance with current rules and regulations governing the disposal of such waste. Disposal fees and miscellaneous charges will be paid by the Subcontractor.
- C. Unless specifically set forth in the Subcontract, burning is not permitted for the disposal of refuse and debris. All rubbish, waste, tools, equipment, and other apparatus caused by or used in the execution of the Work must be removed. This will in no way be construed to relieve the Subcontractor of its primary responsibility for maintaining the facilities and the site clean and free of debris, and leaving all work in a clean and proper condition acceptable to the RE.
- D. Immediately after unpacking, all packing material, case lumber, wrappings, or other rubbish, flammable or otherwise, must be collected and removed from the building and the premises.
- E. Subcontractor must prohibit material and rubbish from entering aircraft operations areas

**PART 2           PRODUCT                   [NOT USED]**

**PART 3           EXECUTION**

**3.1     Progress Cleaning and Waste Removal**

- A. Remove all rubbish, waste, tools, equipment, and appurtenances used from the Worksite at the end of each day to maintain egress, safety, and sanitation.
- B. Remove debris and rubbish from closed or remote spaces before enclosing the space. Collect and remove waste materials, debris, and rubbish from site, and dispose of off-site.
- C. Sweep and vacuum clean interior areas before start of surface finishing and continue cleaning daily to eliminate dust.

**3.2     Overall Cleaning**

- A. Immediately before the final inspection, the entire exterior and interior of any building and the surrounding areas must be thoroughly cleaned by the Subcontractor, including but not limited to the following:
  - 1. All construction facilities, debris, and rubbish must be removed from any building and the site.
  - 2. All finished surfaces within any building must be swept, dusted, vacuumed, washed, or polished as required.
  - 3. All tools, scaffolding, temporary utility connections or buildings, belonging to the Subcontractor, or used under his/her direction, must be removed from the site.

### **3.3 Final Cleaning**

- A. Thoroughly clean entire Worksite and exterior and interior of any building.
- B. Remove debris and rubbish from any building and the Worksite.
- C. Finished surfaces within any building shall be swept, dusted, vacuumed, washed, or polished as required.
- D. Remove all tools, scaffolding, temporary utility connections or buildings belonging to the Subcontractor or its lower tier subcontractors from the Site.
- E. Reseed disturbed areas. Rake and restore all gravel surfaces.

END OF SECTION 01 74 00

**SECTION 01 77 00  
CLOSEOUT PROCEDURES**

**PART 1           GENERAL**

**1.1     Section Includes**

- A. This section sets out the requirements for Subcontract closeout at completion of the Work.

**1.2     Related Documents**

- A. Section 01 11 00, Summary of Work; Section 01 60 00, Product Requirements; Section 01 71 33, Protection of Adjacent Construction; Section 01 74 00, Cleaning and Waste Management.

**1.3     Final Submittal requirements**

- A. Prior to final acceptance, the Subcontractor must assemble all appropriate warranties, product information, certifications, equipment installation instructions, MSDS sheets, and the results of all tests.

**1.4     Completion Certificate**

- A. When Subcontractor considers the Work completed, Subcontractor must submit a signed certification in the form provided by the SA certifying the following:
1. Contract Documents have been reviewed and Work inspected for compliance with Subcontract, including Punchlist Work, and accepted by the FAA.
  2. All materials used in the project are asbestos and lead free.
  3. Record Documents, As-Built, final project photographs, damage or settlement survey, property survey, Record Drawings and similar final record information as required and acceptable to PM have been submitted by Subcontractor.
  4. Equipment/systems have been tested in the presence of RE and are operational.
  5. Required operational, and maintenance manuals, data and parts list have been submitted and approved.
  6. Spare parts have been provided as required.
  7. Warranties and guarantees have been prepared and found acceptable to SA.
  8. Work is completed, premises cleaned and ready for inspection, temporary facilities and services have been removed, and pre-existing conditions have been restored.
  9. All maintenance personnel have been properly instructed in the use of the facilities and all installed equipment as required by the Contract Documents.
  10. Subcontractor has released all property installed in the performance of the Subcontract and all GFE/GFP not used has been transferred to the Contractor and delivered to place of origin.
  11. Return of all Airport identification badges and keys.

**1.5     Contractor Acceptance Inspection (CAI)**

- A. The Subcontractor must coordinate with the RE the date to schedule the CAI. The Subcontractor must notify the SA in writing seven days (or as otherwise agreed to) before an agreed upon CAI date.
- B. The Subcontractor must have the superintendent present at the CAI. The RE shall conduct an inspection of the facility to verify all Subcontract conditions are met. Any additional required test results must be submitted to the RE at this time. The RE reserves the right to have local FAA personnel conduct additional tests to verify that operational requirements are met. The FAA reserves the right to have airport personnel present to document any concerns regarding final condition of the Site.

**1.6     Punch List**

- A. The RE shall furnish the Subcontractor with a list of discrepancies in the work, material, and equipment (punch list) that were noted during the CAI. Subcontractor must correct all deficiencies, if any, detected during the CAI before final acceptance. Work showing evidence of substandard performance will not be accepted and must be corrected by the Subcontractor at its expense.



**1.7 Final Acceptance of Work**

- A. The Subcontractor must correct discrepancies noted on the punch list prior to the final acceptance. The premises must be thoroughly clean prior to final acceptance. Subcontractor must schedule final inspection and notify in writing the PM and RE seven days (or as otherwise agreed to) before the planned inspection date.
- B. Subcontractor must have the superintendent present at the final inspection. The RE shall conduct the final inspection of the facility to verify all contract conditions are met.
- C. Upon acceptance by Contractor, Subcontractor may submit Final Application for Payment.

**PART 2 PRODUCTS [NOT USED]**

**PART 3 EXECUTION [NOT USED]**

END OF SECTION 01 77 00

**SECTION 02 31 00.13**  
**SUBSURFACE UTILITY INVESTIGATION**

**PART-1 GENERAL**

**1.1 WORK INCLUDED**

All underground utilities in the work area must be positively identified by a third party, independent, private utility locating company in addition to any utility owner locating service and coordinated with the FAA.

This section includes all labor, materials and equipment necessary to establish and ensure the exact location and depth of each existing underground facility/utility, including but not limited to existing electrical, communication conduit direct FAA buried cables, fuel & gas lines, water storm and any other existing underground facility.

This section shall also include the maintaining of open communication beginning at the planning stage and continuing to the completion of the project. No trenching or excavation work shall be performed by the subcontractor unless the site has been surveyed and utilities marked by a utility designator firm.

**1.2 DEFINITIONS**

- A. Excavation: The procedure that includes all activities where the earth is disturbed by mechanical or non-mechanical methods. These methods shall include excavating, trenching, pneumatic/vacuum exploratory extraction (potholing), vertical and horizontal boring, directional drilling and any other ground penetrations and the digging of postholes and the driving of ground rods.
- B. High Priority: Any utility that, if damaged, would disrupt the normal operations and/or any utility designated “high priority” by its operator/owner.
- C. Utility: Any underground facility/utility including telephone, power, water, gas, sewer, storm water, and FAA communications/electronics. Utility owners include the telephone company; electrical power service; sewer, water and gas utilities.

**1.3 RELATED DOCUMENTS**

Section 01 10 00	SUMMARY OF WORK
Section 01 33 00	SUBMITTAL PROCEDURES

**1.4 SCHEDULING**

Complete all subsurface utility explorations and obtain written permission to proceed from Parsons WRPM prior to start of any excavation work.

**1.5 QUALITY CONTROL**

Provide proposed foundation and trench profiles to Parsons WRPM for verification. The cost of all labor, materials and equipment necessary to remove, repair and/or reconstruct any of the work due to inaccurate information or damage to the existing under ground facility or electrical conduit/cable by the subcontractor shall be at the subcontractor’s expense.

**1.5.1 Utility Location Verification**

Physically verify underground utility locations, including utility depth, by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within five feet of the underground system.

### **1.5.2 Utilities Within and Under Concrete, Bituminous Asphalt, and Other Impervious Surfaces**

Utilities located within and under concrete slabs or pier structures, bridges, parking areas, and the like, are extremely difficult to identify. Whenever contract work involves chipping, saw cutting, or core drilling through concrete, bituminous asphalt or other impervious surfaces, the existing utility location must be coordinated with local utility departments in addition to location and depth verification by a third party, independent, private locating company. The third party, independent, private locating company shall locate utility depth by use of Ground Penetrating Radar (GPR), X-ray, bore scope, or ultrasound prior to the start of demolition and construction. Outages to isolate utility systems must be used in coordination with Parsons WRPM in circumstances where utilities are unable to be positively and confidently identified. The use of historical drawings does not alleviate the subcontractor from meeting this requirement.

### **1.5.3 Restoration of service**

Subcontractor shall be responsible for prompt restoration of service to any facility impacted by construction operations. Subcontractor shall immediately repair any damage done to utilities or cables within the work area. A certified splicer shall be on site continuously to splice cables that have been damaged. FAA cables shall be repaired to the standards described in FAA Specifications, FAA-C-1391d, INSTALLATION AND SPLICING OF UNDERGROUND CABLES.

## **1.6 SUBMITTALS**

Parsons approval is required for all submittals listed in this section. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Name, address and capabilities of the Utility Designator Firm. Firm shall have a minimum of three years experience locating underground utilities.
- B. Five (5) copies of drawings showing all underground utilities which cross each proposed excavation location.
- C. Proposed foundation and trench profiles.

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

## **PART-3 EXECUTION**

### **3.1 GENERAL**

- A. The locations and top elevations of each existing utility shall be established relative to a taxiway, runway or roadway edge along each proposed excavation. This information shall be transmitted to the Parsons WRPM for evaluation of the proposed foundation/trench profile. The demolition or excavation of existing airfield pavement, roadways or pavement of any kind shall not be allowed during this operation. Refer to Section 01 10 00, SUMMARY OF WORK for runway safety area and taxiway object free area restrictions on work under this item.
- B. Obtain utility locations from all utility owners. Contact the FAA for its utility locations and provide a minimum of 72 hours advance notice. Contact local One-Call for commercial utility marking.
- C. Excavate only by hand when within five feet (5') of marked existing utility services. 10' minimum separation is required for trenches running parallel to an existing utility.
- D. The necessary personnel, materials, and equipment shall be present for each exploration in the event of cable damage.

### **3.2 PROCEDURE**

The following procedures shall be required for all excavation, trenching and digging activities:

- A. Designate the route and/or construction area, to be excavated using white pre-marking paint prior to the arrival of the locators (Utility Designator Firm) and contacts the One-Call System and the local FAA.

- B. Ensure that all FAA technicians, and One-Call System utilities performing location services mark the entire path in the construction area. Further ensure that all utility Owner/Operators have located their utilities and that their utilities are properly marked.
- C. Be aware of the designated color for each utility as indicated by the Parsons WRPM. If a particular marking fades or is destroyed prior to excavation, contact the appropriate utility location service to remark any underground utilities prior to the start of excavation.
- D. After completion of the utility locations described above, hire a certified independent third party utility location service utilizing electromagnetic and ground penetration radar to search the entire excavation area to confirm the locations of the marked utilities and to identify any additional unidentified utilities that may be in this area. The independent utility locator may use different methods, however, they must be substantiated as the best method for the site to best locate the utilities.
- E. Require that the independent utility location service provide a written report documenting the subsurface utility search results. Provide the Parsons WRPM with a copy of this report prior to any excavation. The Parsons WRPM shall provide a copy of this report to the local FAA point of contact for their review prior to the start of any excavation.
- F. If an unknown utility is discovered during the locating phase, notify the Parsons WRPM. The Parsons WRPM will contact the local FAA to determine if there is an impact on design and to receive direction on how to proceed.
- G. Maintain a current list of names and phone numbers of the One-Call System, and emergency numbers.
- H. Verify and mark locations of disconnects and shut-off valves.
- I. If “high priority” facility lines are identified during the utility location phase, then, notify a representative of the agency responsible for that utility. Request an utility owner’s representative to be onsite during any excavation within the greater of five feet (5’) or the minimum distance recommended by the utility.
- J. Accomplish all excavation within the tolerance zone established by the specifications, the responsible utility, and/or ground penetrating radar location service, by hand digging or pneumatic vacuum extraction.
- K. If an underground facility or utility that was previously marked is not found, stop the excavation immediately. Contact Parsons WRPM, and the appropriate owner/operator of the utility directly or through the One-Call System.
- L. Notify the Parsons WRPM, the FAA, the One-Call System, and the Owner/Operator of any underground facility or utility that is discovered as damaged, or has been damaged or contacted during the excavation.
- M. The Subcontractor shall take care to maintain due diligence not to damage existing facilities and utilities during backfill and compaction.

### **3.3 INSPECTIONS**

- A. Prior to any excavation, all control points established per the Risk Management Plan shall be inspected by the Parsons RE.

### **3.4 UNKNOWN UTILITIES**

- A. If unknown and unmarked utilities are encountered during excavation, immediately notify Parsons RE of the location and type of utility encountered.

**END OF SECTION**

**THIS PAGE INTENTIONALLY LEFT BLANK**

## **SECTION 02 40 00 DEMOLITION**

### **PART-1 GENERAL**

#### **1.1 DESCRIPTION**

##### **1.1.1 Demolition Plan**

Prepare a Demolition Plan and submit proposed demolition, deconstruction, and removal procedures for approval before work is started. Include in the plan procedures for careful removal, protection of property which is to remain undisturbed, coordination with other work in progress, a disconnection schedule of utility services, and a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Provide procedures for safe conduct of the work in accordance with Risk Management Plan and OSHA requirements. Demolition Plan shall be approved by Parsons WRPM prior to work beginning.

##### **1.1.2 General Requirements**

Do not begin demolition or deconstruction until authorization is received from the Parsons Subcontract Administrator. Remove rubbish and debris from the project site; do not allow accumulations inside or outside the buildings or on airfield pavements. The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily.

#### **1.2 SUBMITTALS**

Parsons WRPM approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Preconstruction submittals
  - a. Demolition Plan
  - b. Existing Conditions

#### **1.3 ITEMS TO REMAIN IN PLACE**

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Parsons WRPM. Coordinate the work of this section with all other work indicated.

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove dust, dirt, and debris from work areas daily.

##### **1.3.1 Utility Service**

Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations. Prior to start of work; contact the Government for disconnection and sealing of utilities serving each area of alteration or removal.

## 1.4 QUALITY ASSURANCE

Submit timely notification of demolition projects to Federal, State, regional, and local authorities. Notify the State's environmental protection agency and the Parsons WRPM in writing 10 working days prior to the commencement of work. Comply with federal, state, and local hauling and disposal regulations. Comply with the Environmental Protection Agency requirements specified.

Establish and maintain quality control program for the demolition and removal work to assure compliance with subcontract requirements. Maintain records for all demolition and removal operations including but not limited to the following:

- A. **Procedures:** Safety measures, protection of property, coordination of work, and dust control.
- B. **Demolition:** Extent of demolition and disposition of materials.

### 1.4.1 Dust Control

Prevent the spread of dust and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to aircraft.

## 1.5 PROTECTION

Before beginning any cutting or demolition work, carefully survey the existing work and examine the drawings and specifications to determine the extent of the work. Take all necessary precautions to ensure against damage to existing work that will remain in place, be reused, or remain the property of the Government, and any damage to such work shall be repaired or replaced so as to be equal to or better than the pre-construction condition as approved by the Subcontract Administrator at no additional cost to the Government. Carefully coordinate the work of this section with all other work and construct and maintain any necessary protective structures.

### 1.5.1 Protection of Personnel

Before, during and after the demolition work continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the project site.

## 1.6 EXISTING CONDITIONS

Before beginning any demolition or deconstruction work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Parsons RE showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 4 inch will be acceptable as a record of existing conditions. It is the Subcontractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document. Submit survey results.

## PART-2 PRODUCTS

NOT USED

## **PART-3 EXECUTION**

### **3.1 GENERAL:**

Demolition and removal work shall be in compliance with approved demolition procedures and applicable requirements of the applicable agencies having jurisdiction.

#### **3.1.1 Utilities and Related Equipment**

##### **3.1.1.1 General Requirements**

Do not begin demolition or deconstruction work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

### **3.2 DISPOSITION OF EQUIPMENT AND MATERIALS:**

#### **3.2.1 Designation of Government Salvage, Unsalvageable Property or Rubble:**

All fixtures desired for salvage shall be designated as “Salvage” by the Subcontract Administrator or designated representative. All remaining materials and equipment not designated as salvage are “Unsalvageable Material” or “Rubble”.

#### **3.2.2 Disposition of Unsalvageable Material:**

The Subcontractor shall remove all unsalvageable materials and rubble from the work areas. The unsalvageable materials removed from the work areas shall be disposed of by the Subcontractor outside of the limits of the site or the leased areas at the Subcontractor’s responsibility and expense in accordance with all governmental agencies having jurisdiction.

#### **3.2.3 Items with Unique/Regulated Disposal Requirements**

Remove and dispose of items with unique or regulated disposal requirements in the manner dictated by law or in the most environmentally responsible manner.

### **3.3 CLEAN-UP:**

Remove debris and rubbish from the site daily. Do not allow debris to accumulate in building nor on-site. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Immediately clean up any spillage or tracking of soil or debris onto pavement outside the work area.

Apply local regulations regarding hauling and disposal.

### **3.4 DISPOSAL OF REMOVED MATERIALS**

#### **3.4.1 Regulations**

Dispose of debris, rubbish, scrap, and other non salvageable materials resulting from removal operations with all applicable federal, state and local regulations. Storage of removed materials on the project site is prohibited. Comply with all regulations regarding hauling and disposal of removed materials. The legal disposal of removed materials and debris is the Subcontractor’s responsibility.

**END OF SECTION**



**THIS PAGE INTENTIONALLY LEFT BLANK**

**SECTION 02 93 00**  
**EXTERIOR PLANTING**

**PART-1 GENERAL**

**1.1 REFERENCES**

**ALL APPLICABLE REGULATIONS, LAWS, AND PUBLICATIONS:** The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. All publications shall be the latest version/edition/revision of the documents listed below, in effect on the date of this solicitation, except where a date is given.

**AMERICAN NURSERY AND LANDSCAPE ASSOCIATION (ANLA)**

ANLA ANSI/ANLA Z60.1                      Nursery Stock

**AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)**

ANSI A300                                      Tree Care Operations - Trees, Shrubs and other Woody Plant Maintenance

**AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

ASTM C 602                                    Agricultural Liming Materials  
ASTM D 4972                                 pH of Soils  
ASTM D 5034                                 Breaking Strength and Elongation of Textile Fabrics (Grab Test)  
ASTM D 5035                                 Breaking Strength and Elongation of Textile Fabrics (Grab Test)  
ASTM D 5268                                 Topsoil Used for Landscaping Purposes

**1.2 SUBMITTALS**

The following shall be submitted in accordance with AF Form 66 and Section 01010 GENERAL:

**Product Data**

Geotextile. Chemical Treatment Material.

Manufacturer's literature including physical characteristics, application and installation instructions for geotextile and chemical treatment material.

**Shop Drawings**

Shop Drawings

Scale drawings defining areas to receive plant materials.

**Reports**

Soil Test. Percolation Test

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

#### Certificates

Plant Material. Topsoil. pH Adjuster. Fertilizer. Organic Material. Soil Conditioner. Organic Mulch. Mycorrhizal Fungi Inoculum. Pesticide.

Prior to delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following.

- a. Plant Material: Classification, botanical name, common name, size, quantity by species, and location where grown.
- b. Topsoil: Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.
- c. pH Adjuster: Sieve analysis and calcium carbonate equivalent.
- d. Fertilizer: Chemical analysis and composition percent.
- e. Organic Material: Composition and source.
- f. Soil Conditioner: Composition and source.
- g. Organic Mulch: Composition, source, and treatment against fungi growth.
- h. Mycorrhizal Fungi Inoculum: Plant material treated.
- i. Pesticide. EPA registration number and registered uses.

#### Records

Maintenance Record.

Maintenance work performed, quantity of plant losses, and replacements; and diagnosis of unhealthy plant material.

Application of Pesticide

Pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

### 1.3 SOURCE INSPECTIONS

The nursery or source of plant material and the source of delivered topsoil shall be subject to inspection.

### 1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

#### 1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

##### 1.4.1.1 Plant Material Identification

Plant material shall be identified with attached, durable, waterproof labels and weather-resistant ink, stating the correct botanical plant name and size.

##### 1.4.1.2 Protection During Delivery

Plant material shall be protected during delivery to prevent desiccation and damage to the branches, trunk, root system, or earth ball. Branches shall be protected by tying-in. Exposed branches shall be covered during transport.

##### 1.4.1.3 Delivered Topsoil

Prior to the delivery of any topsoil, the availability of topsoil shall be verified in paragraph TOPSOIL. A soil test shall be provided for delivered topsoil.

##### 1.4.1.4 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

##### 1.4.1.5 Pesticide Material

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the Environmental Protection Agency (EPA) registration number and the manufacturer's registered uses.

#### 1.4.2 Inspection

Plant material shall be well shaped, vigorous and healthy with a healthy, well branched root system, free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement or abrasion. Plant material shall be checked for unauthorized substitution and to establish nursery grown status. Plant material showing desiccation, abrasion, sun-scald injury, disfigurement, or unauthorized substitution shall be rejected. The plant material shall exhibit typical form of branch to height ratio; and meet the caliper and height measurements specified. Plant material that measures less than specified, or has been poled, topped off or headed back, shall be rejected. Container-grown plant material shall show new fibrous roots and the root mass shall contain its shape when removed from the container. Plant

material with broken or cracked balls; or broken containers shall be rejected. Bare-root plant material that is not dormant or is showing roots were pulled from the ground shall be rejected. Other materials shall be inspected for compliance with paragraph PRODUCTS. Open soil amendment containers or wet soil amendments shall be rejected. Topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material larger than 1-1/2 inch diameter shall be rejected. Topsoil that contains viable plant material and plant parts shall be rejected. Unacceptable material shall be removed from the job site.

#### 1.4.3 Storage

##### 1.4.3.1 Plant Material Storage

Plant material not installed on the day of arrival at the site shall be stored and protected in designated areas. Plant material shall not be stored longer than 30 days. Plant material shall be protected from direct exposure to wind and sun. Bare-root plant material shall be heeled-in. All plant material shall be kept in a moist condition by watering with a fine mist spray until installed.

##### 1.4.3.2 Other Material Storage

Storage of other material shall be in designated areas. Soil amendments shall be stored in dry locations and away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with planting operation material.

#### 1.4.4 Handling

Plant material shall not be injured in handling. Cracking or breaking the earth ball of balled and burlapped plant material shall be avoided. Plant material shall not be handled by the trunk or stems. Materials shall not be dropped from vehicles.

#### 1.4.5 Time Limitation

Except for container-grown plant material, the time limitation from digging to installing plant material shall be a maximum 90 days. The time limitation between installing the plant material and placing the mulch shall be a maximum 24 hours.

### 1.5 WARRANTY

Furnished plant material shall have a warranty for plant growth to be in a vigorous growing condition for a minimum 12 month period. A minimum 12 month calendar time period for the warranty of plant growth shall be provided regardless of the contract time period. When plant material is determined to be unhealthy in accordance with paragraph PLANT ESTABLISHMENT PERIOD, it shall be replaced once under this warranty.

### 1.6 PLANTING TIME

Planting time shall conform to the base standard between the months of May through September only.

## PART-2 PRODUCTS

### 2.1 PLANT MATERIAL

#### 2.1.1 Plant Material Classification

The plant material shall be nursery grown stock conforming to ANLA ANSI/ANLA Z60.1 and shall be the species specified.

#### 2.1.2 Plant Schedule

The plant schedule shall provide botanical names as included in one or more of the publications listed under "Nomenclature" in ANLA ANSI/ANLA Z60.1.

#### 2.1.3 Substitutions

Substitutions will not be permitted without written request and approval from the Contracting Officer.

#### 2.1.4 Quality

Well shaped, well grown, vigorous plant material having healthy and well branched root systems in accordance with ANLA ANSI/ANLA Z60.1 shall be provided. Plant material shall be provided free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion. Plant material shall be free of shock or damage to branches, trunk, or root systems, which may occur from the digging and preparation for shipment, method of shipment, or shipment. Plant quality is determined by the growing conditions; method of shipment to maintain health of the root system; and growth of the trunk and crown as follows.

#### 2.1.5 Growing Conditions

Plant material shall be native to or well-suited to the growing conditions of the project site. Plant material shall be grown under climatic conditions similar to those at the project site.

#### 2.1.6 Method of Shipment to Maintain Health of Root System

##### 2.1.6.1 Balled and Burlapped (BB) Plant Material

Ball size and ratio shall be in accordance with ANLA ANSI/ANLA Z60.1. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. The plant stem or trunk shall be centered in the ball. All roots shall be clean cut at the ball surface. Roots shall not be pulled from the ground. Before shipment the root ball shall be dipped in gels containing mycorrhizal fungi inoculum. The root ball shall be completely wrapped with burlap or other suitable material and securely laced with biodegradable twine.

##### 2.1.6.2 Balled and Potted (Pot) Plant Material

Ball size and ratio shall be in accordance with ANLA ANSI/ANLA Z60.1. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. Removal shall be done

by hand digging or mechanical devices. The plant stem or trunk shall be centered in the ball. All roots shall be clean cut at the ball surface. Roots shall not be pulled from the ground. Before shipment the root ball shall be dipped in gels containing mycorrhizal fungi inoculum. Container shall be used to retain the ball unbroken. Container shall be rigid to hold ball shape and protect root mass during shipping.

#### 2.1.6.3 Container-Grown (C) Plant Material

Container size shall be in accordance with ANLA ANSI/ANLA Z60.1. Plant material shall be grown in a container over a duration of time for new fibrous roots to have developed and for the root mass to retain its shape and hold together when removed from the container. Container-grown plant material shall be inoculated with mycorrhizal fungi during germination in the nursery. Before shipment the root system shall be dipped in gels containing mycorrhizal fungi inoculum. The container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

#### 2.1.7 Growth of Trunk and Crown

##### 2.1.7.1 Deciduous Trees

A height to caliper relationship shall be provided in accordance with ANLA ANSI/ANLA Z60.1. Height of branching shall bear a relationship to the size and species of tree specified and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

- a. Single stem: The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.
- b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there shall be no division of the trunk which branches more than 6 inches from ground level.
- c. Specimen: The tree provided shall be well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

##### 2.1.7.2 Deciduous Shrubs

Deciduous shrubs shall have the height and number of primary stems recommended by ANLA ANSI/ANLA Z60.1. Acceptable plant material shall be well shaped, with sufficient well-spaced side branches, and recognized by the trade as typical for the species grown in the region of the project.

#### 2.1.8 Plant Material Size

Plant material shall be furnished in sizes indicated. Plant material larger in size than specified may be provided at no additional cost to the Government.

#### 2.1.9 Plant Material Measurement

Plant material measurements shall be in accordance with ANLA ANSI/ANLA Z60.1.

## 2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite in accordance with Section 02300 EARTHWORK. When additional topsoil is required beyond the available topsoil from the stripping operation, topsoil shall be delivered and amended as recommended by the soil test for the plant material specified. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 1-1/2 inch diameter. Topsoil shall be free from viable plants and plant parts.

## 2.3 SOIL AMENDMENTS

Soil amendments shall consist of pH adjuster, fertilizer, organic material and soil conditioners meeting the following requirements. Vermiculite is not recommended.

### 2.3.1 pH Adjuster

The pH adjuster shall be an agricultural liming material in accordance with ASTM C 602. These materials may be burnt lime, hydrated lime, ground limestone, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified.

### 2.3.2 Limestone

Limestone material shall contain a minimum calcium carbonate equivalent of 80 percent. Gradation: A minimum 95 percent shall pass through a No. 8 sieve and a minimum 55 percent shall pass through a No. 60 sieve. To raise soil pH, ground limestone shall be used.

### 2.3.3 Hydrated Lime

Hydrated lime shall contain a minimum calcium carbonate equivalent of 110 percent. Gradation: A minimum 100 percent shall pass through a No. 8 sieve and a minimum 97 percent shall pass through a No. 60 sieve.

### 2.3.4 Fertilizer

The nutrients ratio shall be 8 percent nitrogen, 8 percent phosphorus, and 8 percent potassium. Fertilizer shall be controlled release commercial grade; free flowing, pellet or tablet form; uniform in composition; and consist of a nitrogen-phosphorus-potassium ratio. The fertilizer shall be derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

### 2.3.5 Organic Material

Organic material shall consist of either bonemeal, peat, rotted manure, decomposed wood derivatives, recycled compost, or worm castings.



#### 2.3.5.1 Bonemeal

Bonemeal shall be a finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

#### 2.3.5.2 Rotted Manure

Rotted manure shall be unleached horse, chicken, or cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. Manure shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and shall be free of stones, sticks, and soil.

### 2.3.6 Soil Conditioner

Soil conditioner shall be sand, super absorbent polymers, calcined clay, or gypsum for single use or in combination to meet topsoil requirements for the plant material specified.

#### 2.3.6.1 Sand

Sand shall be clean and free of toxic materials. Gradation: A minimum 95 percent by weight shall pass a No. 10 sieve and a minimum 10 percent by weight shall pass a No. 16 sieve. Greensand shall be balanced with the inclusion of trace minerals and nutrients.

#### 2.3.6.2 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum 95 percent calcium sulfate by volume.

## 2.4 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region. Rotted manure is not recommended to be used as a mulch because it would encourage surface rooting of the plant material and weeds.

### 2.4.1 Organic Mulch

Organic mulch materials shall be native to the project site and consist of recycled mulch, shredded bark, wood chips, or ground bark.

#### 2.4.1.1 Shredded Bark

Locally shredded material shall be treated to retard the growth of mold and fungi.

## 2.5 WOOD STAKING MATERIAL

Wood stakes shall be hardwood or fir; rough sawn; free from knots, rot, cross grain, or other defects that would impair their strength.

### 2.5.1 Bracing Stake

Wood bracing stakes shall be a minimum 2 x 2 inch square and a minimum 8 feet long with a point at one end. Stake shall be set without damaging rootball.

2.5.2 Wood Ground Stakes  
Wood ground stakes shall be a minimum of 2 x 2 inch square and a minimum 3 feet long with a point at one end.

2.5.3 Deadmen  
Wood deadmen shall be a minimum 4 x 4 x 36 inches long.

## 2.6 METAL STAKING AND GUYING MATERIAL

Metal shall be aluminum or steel consisting of recycled content made for holding plant material in place.

2.6.1 Bracing Stakes  
Metal bracing stakes shall be a minimum 1 inch diameter and a minimum 8 feet long. Stake shall be set without damaging rootball.

2.6.2 Metal Ground Stakes  
Metal ground stakes shall be a minimum 1/2 inch diameter and a minimum 3 feet long.

2.6.3 Earth Anchor  
Metal earth anchors shall be a minimum 1/2 inch diameter and a minimum 2 feet long.

2.6.4 Guying Material  
Metal guying material shall be a minimum 12 gauge wire. Multi-strand cable shall be woven wire. Guying material tensile strength shall conform to the size of tree to be held firmly in place.

2.6.5 Turnbuckle  
Metal turnbuckles shall be galvanized or cadmium-plated steel, and shall be a minimum 3 inches long with closed screw eyes on each end. Screw thread tensile strength shall conform to the size of tree to be held firmly in place.

## 2.7 PLASTIC STAKING AND GUYING MATERIAL

Plastic shall consist of recycled plastic product made for holding plant material firmly in place. Plastic shall not be used for deadmen.

2.7.1 Plastic Bracing Stake  
Plastic bracing stakes shall be a minimum 2 inch diameter and a minimum 8 feet long. Stake shall be set without damaging rootball.

2.7.2 Plastic Ground Stakes  
Plastic ground stakes shall be a minimum 1 inch diameter and a minimum 3 feet long.

2.7.3 Plastic Guying Material  
Plastic guying material shall be designed specifically for the purpose of firmly holding plant material in high wind velocities.

#### 2.7.4 Chafing Guard

Plastic chafing guards shall be used to protect tree trunks and branches when metal is used as guying material. The material shall be the same color throughout the project site. Length shall be a minimum 1.5 times the circumference of the plant trunk at its base.

#### 2.8 RUBBER GUYING MATERIAL

Rubber chafing guards, consisting of recycled material, shall be used to protect tree trunks and branches when metal guying material is applied. The material shall be the same color throughout the project. Length shall be a minimum 1.5 times the circumference of the plant trunk at its base.

#### 2.9 FLAG

Plastic flag material shall be used on guying material. It shall be a minimum 6 inches long. Tape color shall be consistent and visually complimentary to the entire project area. The tape color shall meet pedestrian visual safety requirements for day and night.

#### 2.10 TREE ROOT BARRIERS

Tree root barriers shall be metal or plastic consisting of recycled content. Barriers shall utilize vertical stabilizing members to encourage downward tree root growth. Barriers shall limit, by a minimum 90 percent, the occurrence of surface roots. Tree root barriers which are designed to be used as plant pit liners will be rejected.

#### 2.11 MYCORRHIZAL FUNGI INOCULUM

Mycorrhizal fungi inoculum shall be composed of multiple-fungus inoculum as recommended by the manufacturer for the plant material specified.

#### 2.12 WATER

Unless otherwise directed, water shall be the responsibility of the Contractor. Water shall not contain elements toxic to plant life.

#### 2.13 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification a soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

### PART-3 EXECUTION

#### 3.1 INSTALLING PLANT MATERIAL TIME AND CONDITIONS

##### 3.1.1 Deciduous Plant Material Time

Deciduous plant material shall be installed from May 1 to October 15.

##### 3.1.2 Evergreen Plant Material Time

Evergreen plant material shall be installed from May 1 to October 15.

##### 3.1.3 Plant Material Conditions

Planting operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, frozen ground or other unsatisfactory conditions

prevail, the work shall be stopped when directed. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted for approval.

#### 3.1.4 Tests

##### 3.1.4.1 Percolation Test

Test for percolation shall be done to determine positive drainage of plant pits and beds. A positive percolation shall consist of a minimum 1 inch per 3 hours; when a negative percolation test occurs, a shop drawing shall be submitted indicating the corrective measures.

##### 3.1.4.2 Soil Test

Delivered topsoil, excavated plant pit soil, and stockpiled topsoil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size, pH, organic matter content, textural class, chemical analysis, soluble salts analysis, and mechanical analysis. Sample collection onsite shall be random over the entire site. Sample collection for stockpiled topsoil shall be at different levels in the stockpile. The soil shall be free from debris, noxious weeds, toxic substances, or other materials harmful to plant growth. The test shall determine the quantities and type of soil amendments required to meet local growing conditions for the plant material specified.

### 3.2 SITE PREPARATION

#### 3.2.1 Finished Grade, Topsoil and Underground Utilities

The Contractor shall verify that finished grades are as indicated on drawings, and that the placing of topsoil, the smooth grading, and the compaction requirements have been completed in accordance with Section 02300 EARTHWORK, prior to the commencement of the planting operation. The location of underground utilities and facilities in the area of the planting operation shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

#### 3.2.2 Layout

Plant material locations and bed outlines shall be staked on the project site before any excavation is made. Plant material locations may be adjusted to meet field conditions.

#### 3.2.3 Protecting Existing Vegetation

When there are established lawns in the planting area, the turf shall be covered and/or protected during planting operations. Existing trees, shrubs, and plant beds that are to be preserved shall be barricaded along the dripline to protect them during planting operations.

### 3.3 EXCAVATION

#### 3.3.1 Obstructions Below Ground

When obstructions below ground affect the work, shop drawings showing proposed adjustments to plant material location, type of plant and planting method shall be submitted for approval.

#### 3.3.2 Turf Removal

Where the planting operation occurs in an existing lawn area, the turf shall be removed from the excavation area to a depth that will ensure the removal of the entire root system.

### 3.3.3 Plant Pits

Plant pits for ball and burlapped or container plant material shall be dug to a depth equal to the height of the root ball as measured from the base of the ball to the base of the plant trunk. Plant pits for bare-root plant material shall be dug to a depth equal to the height of the root system. Plant pits shall be dug a minimum 50 percent wider than the ball or root system to allow for root expansion. The pit shall be constructed with sides sloping towards the base as a cone, to encourage well aerated soil to be available to the root system for favorable root growth. Cylindrical pits with vertical sides shall not be used.

## 3.4 INSTALLATION

### 3.4.1 Setting Plant Material

Plant material shall be set plumb and held in position until sufficient soil has been firmly placed around root system or ball. In relation to the surrounding grade, the plant material shall be set even with the grade at which it was grown.

### 3.4.2 Tree Root Barrier

Tree root barriers shall be installed as recommended by the manufacturer. Tree root barriers shall be used for trees located up to a maximum 6 feet from paved surfaces or structures.

### 3.4.3 Backfill Soil Mixture

The backfill soil mixture may be a mix of topsoil and soil amendments suitable for the plant material specified. When practical, the excavated soil from the plant pit that is not amended provides the best backfill and shall be used.

### 3.4.4 Adding Mycorrhizal Fungi Inoculum

Mycorrhizal fungi inoculum shall be added as recommended by the manufacturer for the plant material specified.

### 3.4.5 Backfill Procedure

Prior to backfilling, all metal, wood, synthetic products, or treated burlap devices shall be removed from the ball or root system avoiding damage to the root system. The backfill procedure shall remove air pockets from around the root system. Additional requirements are as follows.

### 3.4.6 Balled and Burlapped, and Balled and Platformed Plant Material

Biodegradable burlap and tying material shall be carefully opened and folded back from the top a minimum 1/3 depth from the top of the root ball. Backfill mixture shall be added to the plant pit in 6 inch layers with each layer tamped.

#### 3.4.6.1 Container-Grown and Balled and Potted Plant Material

The plant material shall be carefully removed from containers that are not biodegradable. Prior to setting the plant in the pit, a maximum 1/4 depth of the root mass, measured from the bottom, shall be spread apart to promote new root growth. For plant material in biodegradable containers the container shall be split prior to setting the plant with container. Backfill mixture shall be added to the plant pit in 6 inch layers with each layer tamped.

#### 3.4.6.2 Plant Bed

Plant material shall be set in plant beds according to the drawings. Backfill soil mixture shall be placed on previously scarified subsoil to completely surround the root balls, and shall be brought to a smooth and even surface, blending to existing areas. Earth berms shall be provided. Polymers shall be spread uniformly over the plant bed and in the planting pit as recommended by the manufacturer and thoroughly incorporated into the soil to a maximum 4 inch depth.

#### 3.4.6.3 Watering

Plant pits and plant beds shall be watered immediately after backfilling, until completely saturated.

#### 3.4.6.4 Staking and Guying

Staking will be required when trees are unstable or will not remain set due to their size, shape, or exposure to high wind velocity.

##### 3.4.6.4.1 One Bracing Stake

Trees 4 to 6 feet high shall be firmly anchored in place with one bracing stake. The bracing stake shall be placed on the side of the tree facing the prevailing wind. The bracing stake shall be driven vertically into firm ground and shall not injure the ball or root system. The tree shall be held firmly to the stake with a double strand of guying material. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. A chafing guard shall be used when metal is the guying material.

#### 3.5 Two Bracing Stakes

Trees from 6 to 8 feet height shall be firmly anchored in place with 2 bracing stakes placed on opposite sides. Bracing stakes shall be driven vertically into firm ground and shall not injure the ball or root system. The tree shall be held firmly between the stakes with a double strand of guying material. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. Chafing guards shall be used when metal is the guying material.

##### 3.5.1 Three Ground Stakes

Trees over a minimum 8 feet height and less than a maximum 6 inch caliper shall be held firmly in place with 3 bracing or ground stakes spaced equidistantly around the tree. Ground stakes shall be avoided in areas to be mowed. Stakes shall be driven into firm ground outside the earth berm. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. For trees over maximum 3 inch diameter at breast height, turnbuckles shall be used on the guying material for tree straightening purposes. One turnbuckle shall be centered on each guy line. Chafing guards shall be used when metal is the guying material.

##### 3.5.2 Deadmen or Earth Anchors

Trees over a minimum 6 inch caliper shall be held firmly in place with wood deadmen buried a minimum 3 feet in the ground or metal earth anchors. Multi-strand cable guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. Turnbuckles shall be used on the guying material for tree straightening purposes. One turnbuckle shall be centered on each guy line. Chafing guards shall be used.

### 3.5.3 Flags

A flag shall be securely fastened to each guy line equidistant between the tree and the stake, deadmen, or earth anchor. The flag shall be visible to pedestrians.

## 3.6 FINISHING

### 3.6.1 Plant Material

Prior to placing mulch, the installed area shall be uniformly edged to provide a clear division line between the planted area and the adjacent turf area, shaped as indicated. The installed area shall be raked and smoothed while maintaining the earth berms.

### 3.6.2 Placing Geotextile

Prior to placing mulch, geotextile shall be placed as indicated in accordance with the manufacturer's recommendations.

### 3.6.3 Placing Mulch

The placement of mulch shall occur a maximum 48 hours after planting. Mulch, used to reduce soil water loss, regulate soil temperature and prevent weed growth, shall be spread to cover the installed area with a minimum 4 inch uniform thickness. Mulch shall be kept out of the crowns of shrubs, ground cover, and vines and shall be kept off buildings, sidewalks and other facilities.

### 3.6.4 Pruning

Pruning shall be accomplished by trained and experienced personnel. The pruning of trees and palms shall be in accordance with ANSI A300. Only dead or broken material shall be pruned from installed plants. The typical growth habit of individual plant material shall be retained. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to the line of growth will not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off".

## 3.7 MAINTENANCE DURING PLANTING OPERATION

Installed plant material shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed to prevent desiccation and shall continue until the plant establishment period commences. Installed areas shall be kept free of weeds, grass, and other undesired vegetation. The maintenance includes maintaining the mulch, watering, and adjusting settling.

## 3.8 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the installation pest management program.

### 3.8.1 Technical Representative

The certified installation pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control. They may be present during treatment application.

### 3.8.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended as it prevents the pesticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately.

## 3.9 RESTORATION AND CLEAN UP

### 3.9.1 Restoration

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.

### 3.9.2 Clean Up

Excess and waste material shall be removed from the installed area and shall be disposed offsite. Adjacent paved areas shall be cleared.

## 3.10 PLANT ESTABLISHMENT PERIOD

### 3.10.1 Commencement

Upon completion of the last day of the planting operation, the plant establishment period for maintaining installed plant material in a healthy growing condition shall commence and shall be in effect for the remaining contract time period, not to exceed 45 calendar days after Government acceptance. Written calendar time period shall be furnished for the plant establishment period. When there is more than one plant establishment period, the boundaries of the planted area covered for each period shall be described. The plant establishment period shall be coordinated with Sections 02928 Establishment of Turf. The plant establishment period shall be modified for inclement weather shut down periods, or for separate completion dates for areas.

### 3.10.2 Maintenance During Establishment Period

Maintenance of plant material shall include straightening plant material, straightening stakes; tightening guying material; correcting girdling; supplementing mulch; pruning dead or broken branch tips; maintaining plant material labels; watering; eradicating weeds, insects and disease; post-fertilization; and removing and replacing unhealthy plants.

### 3.10.3 Watering Plant Material

The plant material shall be watered as necessary to prevent desiccation and to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is estimated to be the equivalent of 1 inch absorbed water per week, delivered in the form of rain or augmented by watering. Run-off, puddling and wilting shall be prevented. Unless otherwise directed, watering trucks shall not be driven over turf areas. Watering of other adjacent areas or existing plant material shall be prevented.

#### 3.10.3.1 Weeding

Grass and weeds in the installed areas shall not be allowed to reach a maximum 3 inches height before being completely removed, including the root system.



#### 3.10.3.2 Pesticide Treatment

Treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

#### 3.10.3.3 Post-Fertilization

The plant material shall be topdressed at least once during the period of establishment with controlled release fertilizer, reference paragraph SOIL AMENDMENTS. Apply at the rate of 2 pounds per 100 square feet of plant pit or bed area. Dry fertilizer adhering to plants shall be flushed off. The application shall be timed prior to the advent of winter dormancy.

#### 3.10.3.4 Plant Pit Settling

When settling occurs to the backfill soil mixture, additional backfill soil shall be added to the plant pit or plant bed until the backfill level is equal to the surrounding grade. Serious settling that affects the setting of the plant in relation to the maximum depth at which it was grown requires replanting in accordance with paragraph INSTALLATION. The earth berm shall be maintained.

#### 3.10.4 Maintenance Record

A record shall be furnished describing the maintenance work performed, the quantity of plant losses, diagnosis of the plant loss, and the quantity of replacements made on each site visit.

#### 3.10.5 Unhealthy Plant Material

A tree shall be considered unhealthy or dead when the main leader has died back, or up to a maximum 25 percent of the crown has died. A shrub shall be considered unhealthy or dead when up to a maximum 25 percent of the plant has died. This condition shall be determined by scraping on a branch an area 1/16 inch square, maximum, to determine if there is a green cambium layer below the bark. The Contractor shall determine the cause for unhealthy plant material and shall provide recommendations for replacement. Unhealthy or dead plant material shall be removed immediately and shall be replaced as soon as seasonal conditions permit.

#### 3.10.6 Replacement Plant Material

Unless otherwise directed, plant material shall be provided for replacement in accordance with paragraph PLANT MATERIAL. Replacement plant material shall be installed in accordance with paragraph INSTALLATION, and recommendations in paragraph PLANT ESTABLISHMENT PERIOD. Plant material shall be replaced in accordance with paragraph WARRANTY. An extended plant establishment period shall not be required for replacement plant material.

#### 3.10.7 Maintenance Instructions

Written instructions shall be furnished containing drawings and other necessary information for year-round care of the installed plant material; including, when and where maintenance should occur, and the procedures for plant material replacement.

### 3.11 SCHEDULE - PLANT LIST

Refer to Drawings.

**END OF SECTION**

## SECTION 03 00 00 CONCRETE

### PART-1 GENERAL

#### 1.1 SCOPE

This Section specifies cast-in-place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

#### 1.2 CODES AND STANDARDS

Comply with provisions of the following current codes, specifications, and standards, except where more stringent requirements are shown or specified.

- A. ACI 318, "Building Code Requirements for Reinforced Concrete".
- B. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".

#### 1.3 SUBMITTALS

Parsons RE's approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Mix design for all classes of concrete
- B. Product data for reinforcing bars and welded wire fabric
- C. Results of all laboratory or field tests

### PART-2 PRODUCTS

#### 2.1 FORM MATERIALS

- A. **Forms for Exposed Finish Concrete:** Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in large practicable sizes to minimize number of joints and to conform to joint system shown on the drawings.
- B. **Forms for Unexposed Finish Concrete:** Provide plywood, lumber, metal, or other acceptable material. Lumber shall be dressed on at least two edges and one side for tight fit.

#### 2.2 PLYWOOD FORMS

Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, exterior grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

#### 2.3 FORMS COATINGS

Provide commercial form coating that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

## 2.4 FORM TIES

Factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to exposed surface. Provide ties that, when removed, will leave holes not larger than 1-inch diameter in concrete surface.

## 2.5 REINFORCING MATERIALS

- A. **Reinforcing Bars:** ASTM A 615, Grade 60, deformed. Detailed and fabricated in accordance with ACI 315.
- B. **Welded Wire Fabric:** ASTM A 185, welded steel wire fabric.
- C. **Supports for Reinforcement:** Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire-bar-type supports complying with CRSI specifications.
  - 1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
  - 2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

## 2.6 CONCRETE MATERIALS

- A. **Portland Cement:** ASTM C 150, Type I or II. Use one brand of cement throughout project.
- B. **Fly Ash:** ASTM C 618, Type C or Type F.
- C. **Normal Weight Aggregates:** ASTM C 33 and as herein specified. Provide aggregates from a single source for exposed concrete.
  - 1. Do not use fine or coarse aggregates containing deleterious substances that cause spalling.
  - 2. Local aggregates not complying with ASTM C 33 but that special tests or actual service have shown to produce concrete of adequate strength and durability may be used when acceptable to RE.
- D. **Water:** Potable.
- E. **Admixture, General:** Provide admixtures for concrete that contain not more than 0.1 percent chloride ions.
  - 1. Air-Entraining Admixtures - ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
  - 2. Water Reducing Admixture - ASTM C 494, Type A.
  - 3. High-Range Water-Reducing Admixture (Superplasticizer) - ASTM C 494, Type F or Type G.
  - 4. Water-Reducing, Accelerating Admixture - ASTM C 494, Type E.
  - 5. Water-Reducing, Retarding Admixture - ASTM C 494, Type D.

## 2.7 RELATED MATERIALS

- A. **Vapor Retarder:** Use only materials that are resistant to deterioration when tested in accordance with ASTM E 154, as follows: Polyethylene sheet - not less than 8 mils thick.
- B. **Absorptive Cover:** Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
- C. **Moisture-Retaining Cover:** - One of the following, complying with ASTM C 171.
  - 1. Waterproof paper.
  - 2. Polyethylene film.
  - 3. Polyethylene-coated burlap.
- D. **Liquid Membrane-Forming Curing Compound:** Liquid-type membrane-forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.055 gr./sq.cm. when applied at 200 sq.ft./gal.
- E. **Evaporation Control:** Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

## PART-3 EXECUTION

### 3.1 GENERAL

Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

### 3.2 FORMS

- A. **General:** Design, erect, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347. Construct forms to sizes, shapes, lines and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, molding, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.
- B. **Fabrication:** Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
- C. **Temporary Openings:** Provide temporary openings where interior area of formwork is inaccessible for cleanup, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

- D. **Chamfer:** Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- E. **Provisions for Other Trades:** Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- F. **Cleaning and Tightening:** Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms and bracing before concrete placement as required to prevent mortar leaks and maintain proper alignment.

### 3.3 VAPOR RETARDER/BARRIER INSTALLATION

- A. Following leveling and tamping of base for slabs on grade, place vapor retarder/barrier sheeting with longest dimension parallel with direction of pour.
- B. Lap joints 6 inches and seal vapor barrier joints with manufacturer's recommended mastic and pressure-sensitive tape.

### 3.4 PLACEMENT OF REINFORCEMENT

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcement Bars," for details and methods of reinforcement placement and supports and as herein specified.
- B. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations.
- C. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.
- D. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by RE.
- E. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not towards exposed concrete surfaces. Lap distance shall be in accordance with ACI 315. Minimum lap of a bar is 24 times bar diameter.
- F. Install welded wire fabric in lengths as long as practical. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous line of lap in either direction.

### 3.5 PREPARATION OF FORM SURFACES

- A. Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before reinforcement is placed.
- B. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

### 3.6 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 211.1 and batched in accordance with ACI 304.
- B. Limit use of fly ash to not exceed 25 percent of cement content by weight. Fly ash is not to be used where high early strength is specified.
- C. Subcontractor shall design mixes to provide normal weight concrete with the following properties, or as indicated on drawings and schedules: 4500-psi, 28-day compressive strength; W/C ratio, 0.45, air content 6% +/- 1%.
- D. Mix design adjustments may be requested by Subcontractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by PM/RE. Laboratory test data for revised mix design and strength results must be submitted to and accepted by RE before using.

#### 1. Admixtures

- a. Use water-reducing admixture or high-range water-reducing admixture (Superplasticizer) in concrete as required for placement and workability.
- b. Use nonchloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).
- c. Use high-range water-reducing admixture (HRWR) in pumped concrete. Concrete required to be watertight, with water/cement ratios below 0.50.
- d. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within following limits:
- e. Concrete structures and slabs exposed to freezing and thawing - 4.5 percent (moderate exposure) 1-1/2-inch max. aggregate.
- f. Use admixtures for water reduction and set control in strict compliance with manufacturer's directions.

#### 2. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

- a. Ramps, Slabs, and Sloping Surfaces - 3-inches.
- b. Reinforced Foundation Systems - Not less than 1-inch and not more than 3- inches.
- c. Concrete Containing HRWR Admixture (Superplasticizer) - Not more than 8 inches after addition to HRWR to site-verified 2-inch to 3-inch slump concrete.
- d. Other Concrete - Not more than 4-inches.

### 3.7 READY-MIX CONCRETE

- A. Ready-Mix Concrete shall comply with requirements of ASTM C 94, and as specified.
- B. Provide to the PM/RE batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.

- C. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

### 3.8 CONCRETE PLACEMENT

- A. **General:** Comply with ACI 304, “Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete,” and as herein specified.
- B. **Inspection:** Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work.
- C. **Placing Concrete in Forms:** Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete to avoid segregation at its final location.
  - 1. Consolidate placed concrete primarily by mechanical vibrating equipment, supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
  - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6-inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- D. **Placing Concrete Slabs:** Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
  - 1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. The use of added water or other medium to increase surface water in conjunction with use of a float or darbie is not permitted. Do not disturb slab surfaces prior to beginning finishing operations.
  - 3. Maintain reinforcing in proper position during concrete placement.
- E. **Cold-Weather Placing:** Comply with provisions of ACI 306 and as follows.
  - 1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 2. When air temperature has fallen to or is expected to fall below 40 deg f (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
  - 3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.



4. Do not use calcium chloride salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
- F. **Hot-Weather Placing:** When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg f (32 deg 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. Use of liquid nitrogen to cool concrete is Subcontractor'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 embedment in concrete.
  3. Fog-spray forms, reinforcing steel, and subgrade just before concrete is placed.
  4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions.

### 3.9 FINISH OF FORMED SURFACES

- A. **Rough Form Finish:** For formed concrete surfaces not exposed to view in the finish work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4-inch in height rubbed down or chipped off.
- B. **Smooth Form Finish:** For formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.
- C. **Related Unformed Finish:** At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless other wise indicated.

### 3.10 MONOLITHIC SLAB FINISHES

- A. **Scratch Finish:** - Apply scratch finish to monolithic slab surfaces to receive concrete floor topping or mortar setting beds for tile, Portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated. After placing slabs, plane surface to tolerances for floor flatness (Ff) of 15 and floor levelness (F1) of 13. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.
- B. **Trowel Finish:** Apply trowel finish to monolithic slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of Ff 20 - Ff 17. Grind smooth surface defects that would telegraph through applied floor covering system.

- C. **Trowel and Fine Broom Finish:** Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

### 3.11 CONCRETE CURING AND PROTECTION

- A. **General:** Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- B. **Initial Curing:** Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting; keep continuously moist for not less than 7 days.
- C. **Curing Methods:** Perform curing of concrete by moist curing, or by moisture-retaining cover curing, or by curing and sealing compound, or by combinations thereof, as herein specified.

#### 1. **Moist Curing**

- a. Keep concrete surface continuously wet by covering with water; or
  - b. Use continuous water-fog spray; or
  - c. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.
  - d. **Moisture-Retaining Cover Curing:** Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practical width with sides and ends lapped at least 3-inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during period using cover material and waterproof tape.
  - e. **Curing and Sealing Compounds:** Apply curing and sealing compound to exposed interior slabs and to exterior slabs, walks, and curbs. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
- D. **Curing Formed Surfaces:** Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.
  - E. **Curing Unformed Surfaces:** Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces, by application of appropriate curing method.
  - F. **Treated Surfaces:** Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

### 3.12 REMOVAL OF FORMS:

Formwork not supporting weight of concrete, such as walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

### 3.13 CONCRETE SURFACE REPAIRS

- A. Repair and patch defective areas with cement mortar immediately after removal of forms.
- B. Cut out honeycomb, rock pockets, voids over 1/4-inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1-inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar before bonding compound has dried.
- C. **For Exposed-to-View Surfaces:** Blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- D. **Repair of Formed Surfaces:** Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of RE. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface, and stains and other discoloration's that cannot be removed by cleaning. Flush out form tie holes, fill with dry-pack mortar.
- E. **Concealed Formed Surfaces:** Where possible, repair defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
- F. **Repair of Unformed Surfaces:** Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having required slope.
  1. Repair finished unformed surfaces that contain defects that affect durability of concrete. Surface defects, as such, include crazing and cracks in excess of 0.01-inch wide or that penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.
  2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
  3. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with patching compound. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to RE.
  4. Repair defective areas, except random cracks and single holes not exceeding 1-inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish blending with adjacent finished concrete. Cure in same manner as adjacent concrete.

### 3.14 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. **General:** The Subcontractor will employ a testing laboratory to perform tests and to submit test reports. Sampling and testing for quality control during placement of concrete shall include the following.
- B. **Sampling Fresh Concrete:** ASTM C 172, except modified slump to comply with ASTM C 94.
1. **Slump:** ASTM C 143; one test at point of discharge for each day's placement of each type of concrete; additional tests when RE determines that concrete consistency appears to have changed.
  2. **Air Content** - One for each day's placement of each type of air-entrained concrete (ASTM C 173, volumetric method for light weight concrete; ASTM C 231 pressure method for normal weight concrete).
  3. **Concrete Temperature:** Test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and each time a set of compression test specimens is made.
  4. **Compression Test Specimen:** ASTM C 31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cure test specimens are required.
  5. **Compression Strength Tests:** ASTM C 39; one set for each day's placement not exceeding 5 CY, plus additional sets for each 50 CY more than the first 25 CY of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
- C. **Test Results:** Test results will be reported in writing to RE, Ready-Mix Producer, and Subcontractor within 24 hours after tests. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.
- D. **Standards:** Strength level of concrete will be considered satisfactory if averages of sets of three consecutive 28-day strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.
1. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
- E. **Additional Tests:** The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by RE. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Subcontractor shall pay for such tests when unacceptable concrete is verified.

END OF SECTION

## SECTION 03 35 19

### STAINED CONCRETE FINISHES

#### PART 1 – GENERAL

##### 1.1 SUMMARY

###### 1.1.1.1 Section Includes

- a. Cleaning of existing exterior concrete walks.
- b. Application of concrete stain.

###### 1.1.1.2 Related Sections

- a. Section 01 33 00 – Submittal Procedures
- b. Section 03 30 00.00.10 – Cast in Place Concrete
- c. Section 07 92 00 – Joint Sealants

##### 1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

###### 1.2.1 Product Data, G

- a. Manufacturer and model of equipment to be used.
- b. Concrete stain system products.
- c. Manufacturer's color charts showing full range of product colors available.

###### 1.2.2 Contractor Qualifications,

- a. Submit the name, address, telephone number, FAX number, and e-mail address of the contractor that will be performing all surface preparation and stain application. Submit evidence that key personnel have successfully performed surface preparation and application of coatings on a minimum of three similar projects within the past three years. List information by individual and include the following:
  1. Name of individual and proposed position for this work.
  2. Information about each previous assignment including:
    - a) Position or responsibility (if other than the Contractor)
    - b) Name of facility owner
    - c) Mailing address, telephone number, and telex number (if non-US) of facility owner
    - d) Name of individual in facility owner's organization who can be contacted as a reference
    - e) Location, size and description of project
    - f) Dates work was carried out
    - g) Description of work carried out

- h) Provide list of a minimum of 5 projects performed within last five years of similar type, size, and complexity. Submit project names, addresses, contacts, and phone numbers for each project.
  - i) Submit with the bid.
- b. Submit letter of certification from manufacturers of all products and equipment specified herein, stating that the applicator is a certified applicator of the system and is familiar with proper procedures and installation methods as required by the manufacturer. Submit all certifications with the bid.
  - c. Concrete Staining contractor must have been regularly performing Concrete Staining work for at least 3 years prior, evidence of which shall be included with manufacturer certifications or job history. Submitted with the bid.

### 1.2.3 Closeout Submittals,

Submit in accordance with Section 01 78 00.

- a. Maintenance Data: Submit 7 sets of maintenance data as follows:
  - 1. Manufacturer's technical product data and literature.
  - 2. Storage and handling requirements and recommendations.
  - 3. Methods of maintaining stained concrete, including a listing of approved cleaning and stain removal products and procedures.
  - 4. Manufacturer's recommended maintenance schedule.
  - 5. Precautions for cleaning materials and methods that could be detrimental to stained concrete.
  - 6. Manufacturer's safety data sheets and related safety requirements.

## 1.3 QUALITY ASSURANCE

### 1.3.1 Regulatory Requirements

Accessibility Requirements: Comply with applicable requirements of the Americans with Disabilities Act Accessibility Guidelines (ADAAGs) for Buildings and Facilities; Final Guidelines, revisions, and updates for static coefficient of friction for walkway surfaces.

Environmental Requirements: Comply with current Federal and local toxicity and air quality regulations and with Federal requirements on content of lead, mercury, and other heavy metals. Do not use solvents in floor polish products that contribute to air pollution.

### 1.3.2 Mock Up

Prior to commencement of work, prepare mock up for evaluation of surface preparation techniques and application workmanship. Designate 250 square feet for mock up of specified system located where directed by Contracting Officer, and produce mock up using same materials, tools, equipment, and procedures intended for actual surface preparation. Prepare three separate color / pattern schemes for the mock up. Refer to Drawings for colors and patterns to be used on each of the schemes. Include properly prepared walk joints and color pattern. Include walk edges adjoining existing partitions/walls.

Notify Contracting Officer a minimum 7 days prior to date and time when mockups will be performed and completed. Demonstrate proposed range of aesthetic effects and workmanship. Obtain approval of mockups from Contracting Officer before proceeding with work. Maintain mockups during construction in undisturbed condition as a standard for judging completed work. Approved mockups may become part of the completed work if acceptable.

Adequate precautions shall be taken to ensure that the final treated surfaces will not be slippery. For safety considerations, the mockup shall be completed prior to general application, and the entire surface tested to verify the adequacy of wet and dry slip resistance. Obtain Contracting Officer's written approval of slip resistance characteristics prior to commencement work.

### 1.3.3 Pre-Installation Meeting:

Schedule meeting a minimum of one day prior to first staining of existing concrete walks and one week prior to placement of new walks. Notify all required attendees in writing of scheduled time and meeting location at least two weeks in advance. Include copy of agenda.

Require attendance of all entities directly affecting work, including, but not limited to the following. Attendees shall include all personnel directly involved in overseeing and who have authority to control the work.

- a. General Contractor
  - 1. Project Manager
  - 2. Superintendent
- b. Concrete Staining Subcontractor
  - 1. Project Manager
  - 2. Foreman
- c. Concrete Finisher
  - 1. Project Manager
  - 2. Foreman
- d. Architect

Convene meeting only when all required parties are in attendance.

Review the following:

- a. Environmental requirements.
  - 3. Installation of controls to limit damage from excessive dust caused by resilient floor tile removal, surface preparation and final staining.
  - 4. Installation of controls to limit damage from moisture.
  - 5. Compliance with manufacturers' written instructions for substrate temperature and moisture content, ambient temperature, and humidity, ventilation and other conditions affecting product performance.
  - 6. Area shall be closed to traffic during floor finish application and after application, for a time as recommended by finish manufacturer(s).
- b. Scheduling and phasing of work.

- c. Coordination with other work and personnel.
- d. Protection of adjacent surfaces.
- e. Surface preparation.
- f. Repair of walk defects and defective work including cost responsibility.
- g. Application of stain.
- h. Final cleaning/staining.
- i. Field quality control methods.

Record, type, print and distribute minutes of meeting to all parties in attendance within 5 days of the meeting.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

##### 1.4.1 Delivery

Deliver stain material to site in original, factory sealed, unopened, new containers bearing manufacturer's name and label intact and legible, with the following information:

- a. Name or title of material.
- b. Manufacturer's standard container numbers.
- c. Application instructions.

Dispense stain only from factory sealed and numbered containers. Maintain record of container (drum) numbers received and used during treatment.

##### 1.4.2 Storage

Store materials in protected and well-ventilated area at temperatures between 40 and 90 degrees F unless otherwise required by manufacturer. Keep containers sealed until ready for use. Do not use materials beyond manufacturer's shelf life limits.

##### 1.4.3 Handling

Protect materials during handling and application to prevent damage or contamination.

#### 1.5 ENVIRONMENTAL REQUIREMENTS

Limit and control damage from excessive dust caused by surface preparation and staining. Limit and control damage from moisture. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation and other conditions affecting product performance. All replaced concrete shall be cured a minimum of 28 days or until such point equipment can be put on walk without displacing aggregate.

#### 1.6 SEQUENCING AND SCHEDULING

Comply with approved schedule for sequence of operations published by stain manufacturer.

### PART 2 – PRODUCTS



## 2.1 MANUFACTURERS

Subject to compliance with project requirements, products and equipment by the following manufacturer, or equal, may be provided:

- a. L. M. Scofield Company, (800) 800-9900, Los Angeles, CA, (323) 720-3000, and Atlanta, GA, (770) 920-6000.

## 2.2 PRODUCTS

Stain shall be a material that improves the appearance of existing, unsealed exterior colored or uncolored concrete surfaces in need of refurbishment or renovation. Stain shall add a measured amount of color to the concrete without producing a paint-like appearance. Stain shall penetrate and react with the concrete so that colors become part of the surface, producing a luster that will approximate the sheen of newly placed concrete. Stain shall be formulated for easy installation on horizontal concrete surfaces using hand-pump sprayers or rollers. Stain shall resist fading due to exposure to sunlight. It shall be a low-solids product, with a calculated Volatile Organic Compound (VOC) content of less than 120 grams per liter (1.0 lb/gal). Stain shall meet all known air quality requirements and be legal for sale and use in Virginia at Navy facilities as of November 1, 2009.

Subject to compliance with project requirements, the following products and equipment by the manufacturer, or equal, may be provided:

- a. Stain: Stain shall be equal to SCOFIELD® Revive™ Color Refresher as manufactured by L. M. Scofield Company, (800) 800-9900, Los Angeles, CA, (323) 720-3000, and Atlanta, GA, (770) 920-6000. Two colors of product, as selected by Contracting Officer from manufacturer's full range of colors, shall be provided.

## 2.3 EQUIPMENT

### 2.3.1 Power Washers

Provide gasoline powered pressure washers with variable pressure adjustment and a selection of spray tips as required to remove existing coloring system from walks. Provide multiple washers to assure compliance with contractor's schedule for the work in the event of usual equipment maintenance and failure.

### 2.3.2 Spray Applicators

Provide acetone-resistant hand pump-up type portable sprayers. Provide multiple sprayers to assure compliance with contractor's schedule for the work in the event of usual equipment maintenance and failure.

## PART 3 – EXECUTION

### 1.1 EXAMINATION

- a. Examine walks in the presence of the certified applicator and Contracting Officer, identifying all defects. Correct conditions detrimental to timely and proper work as directed by Contracting Officer.
- b. Do not proceed until unsatisfactory conditions are corrected.

## 1.2 WARNINGS

- a. STAIN PRODUCTS IN BOTH LIQUID AND VAPOR STATES MAY BE EXTREMELY FLAMMABLE. VAPORS MAY BE HARMFUL.
- b. STAIN VAPORS MAY CAUSE FLASH FIRE.
- c. STAIN PRODUCTS MAY BE HARMFUL OR FATAL IF SWALLOWED.
- d. KEEP STAIN PRODUCTS OUT OF THE REACH OF CHILDREN.
- e. Follow all manufacturer's product warnings.
- f. Stain products may contain acetone, aromatic hydrocarbon, aromatic petroleum distillates, and trimethylbenzene.
- g. Stain products may affect the brain or nervous system causing dizziness, headache or nausea. Stain products may cause eye, skin, nose and throat irritation. Repeated exposure may cause skin dryness or cracking. If swallowed, stain products may be aspirated and cause lung damage.
- h. Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage. Intentional misuse by deliberately concentrating and inhaling the contents may be harmful or fatal.
- i. Read manufacturer's Material Safety Data Sheets (MSDS) for additional information and observe all warnings.
- j. Keep stain products away from heat, sparks, and flame.
- k. Use stain products only with adequate ventilation. Do not breathe vapors or spray mist. Ensure fresh air entry during application and drying.
- l. In the event of eye watering, headache or dizziness, or if air monitoring demonstrates vapor/mist levels are above applicable limits, wear an appropriate, properly fitted respirator (NIOSH approved) during and after application. Follow respirator manufacturer's directions for respirator use.
- m. Avoid stain products contact with eyes, skin and clothing.
- n. Do not eat, drink or smoke in areas where stain products are being used.
- o. Do not allow vapors from stain products to penetrate into foodstuffs.
- p. Assure that no animals access the site until all vapors have dissipated.
- q. Turn off or extinguish all pilot lights and other flames which might ignite the stain product.
- r. The stain product shall be nontoxic in its cured state.

## 1.3 WALK PREPARATION

Contractor shall protect areas to receive concrete stain finish at all times during construction (before, during and after application of stain) to prevent traffic, oils, dirt, metal, excessive water, paint and other potentially damaging materials from affecting the finished concrete surface. Close areas to traffic during application of stain. Provide protection as necessary, including flagmen, signs, barricades and caution tape.

- a. Inform all subcontractors and trades that walks must be protected at all times.
- b. All concrete walk surfaces to be treated must be dry and frost free.
- c. Walk surfaces must be porous and not sealed, coated, or covered with materials that will impede penetration. Ensure surfaces are clean, dry, and free of existing concrete coloring, oil, grease, dirt, dust, and other contaminants.

- a. Clean concrete walk substrate as necessary and as otherwise recommended by stain manufacturer. Remove existing concrete coloring and any other surface contaminants to ensure penetration of stain. No hazardous, flammable, toxic or solvent based cleaning materials are permitted. Necessary cleaning, and cleaning methods acceptable to the stain manufacturer may include:
  1. Remove dust and loose material by brushing, sweeping, vacuuming and power washing.
  2. Remove curing, sealing and coating agents, oil, breaking compound residue, wax, and grease by mechanically scraping off heavy deposits. Remove remaining residues using Wax and Curing Compound Remover.
  3. Remove deep-set oil and grease stains.
  4. Remove paint residue.
  5. Remove grease and general soiling with cleaner/degreaser diluted as recommended by manufacturer in an auto scrubber.
  6. Remove mildew by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water.
  7. Thoroughly rinse walk surface to remove soap residue and contaminants.
  8. Squeegee or broom-brush dry.
- b. Fill walk joints in accordance with Section 07 92 00, paragraph 1.1.2.
- c. Repair all walk defects.
- d. Protect surrounding and adjacent surfaces in accordance with stain manufacturer's written recommendations.
- e. Mask walks prior to staining to achieve different colored borders. Use masking tape and painter's paper to prevent overspray and broom brushing from contaminating other color areas. Assure that tape is pressed into any rough surfaces in the walks so as to result in a crisp line at color changes.

## 1.4 STAIN APPLICATION

### 1.4.1 Mixing Stain

Thoroughly mix stain as directed by manufacturer.

- a. Stain products may require mixing of two part (A and B) systems. Thoroughly mix part A separately before adding Part A to Part B. The sides and bottom of the Part A container must be thoroughly scraped to transfer all of the tint concentrate to Part B. Using a suitable paint stick, hand-stir the material until a streak-free color is reached, which should take approximately 3 minutes.
- b. Do not use a power drill and paddle to mix stain material.
- c. Transfer mixed material into a separate container and mix a second time to insure that all part A has been mixed into part B.
- d. After combining the components, material from different lot numbers should be mixed together to minimize the possibility of color variation.
- e. Frequent remixing must be performed during use to ensure uniform color distribution.

### 1.4.2 Applying Stain

- a. Do not apply stain by airless sprayer or any other method that generates a fine mist.
- b. Apply stain only on cured horizontal concrete surfaces that are adequately textured for slip resistance.

- c. Apply stain at temperatures between 40° F (4° C) and 95° F (35° C) or as otherwise stated in manufacturer's instructions.
- d. Apply stain only on calm days when concrete and air temperatures are between 40 – 95° F (4 – 35° C). Do not apply stain during rainy, foggy, or very humid weather, when condensation could form on the surface, or if rain is expected within 24 hours after installation.
- e. Create colored borders by alternatively masking the various areas to be stained with tape and painter's masking paper to prevent overspray and broom brushing from contaminating other color areas. Apply stain to vertical sides of walk where visible.
- f. Using the acetone-resistant pump-up sprayer, apply freshly mixed stain liberally to the concrete surface until no more material is absorbed. Do not allow material to puddle. Control coverage to keep surface visibly wet with material while spraying, but while avoiding over-application. Use a soft-bristled push broom to work material into the surface and continue working until the surface is dry.
- g. Stain may be applied using an appropriate roller as an alternative. Back roll at right angles while the material is still wet and roll until the surface is dry.
- h. If any residue remains after treatment (more likely if two coats are applied), scrub and rinse with water to avoid tracking residual color to adjacent areas. If the treated concrete surface absorbs water and darkens during the scrubbing and rinsing process, the concrete's pores are not fully blocked and application of additional stain may be recommended by manufacturer to achieve full water protection.

## 1.5 FINISH AND PROTECTION

- a. Protect walk surfaces from moisture for 72 hours to prevent re-emulsification of surface treatment prior to cure.
- b. Allow four to eight hours drying time before permitting foot traffic. Drying time will depend on temperature and surface porosity. Do not pressure wash or use other aggressive cleaning methods for at least two weeks after application.
- c. Do not place wood pallets directly on walk surface for 72 hours. If placement of pallets on the walks is necessary after this initial drying time, use face down carpet to prevent moisture in wood from contacting the concrete surface.
- d. Do not place steel on the finished walk to avoid rust staining.
- e. Do not allow acids or acidic detergents to come in contact with the stained surfaces.
- f. Require use of drop cloths during all painting. Immediately wipe clean spilled paint.
- g. Diaper any hydraulic equipment which will be allowed on walks to avoid staining.
- h. All residue must be disposed of in accordance with local and Base regulations.
- i. After the treated and washed surfaces are completely dry to the touch, the area is suitable for general use. Thoroughly inspect all treated surfaces to verify that proper application has been accomplished, and to assure safety of the walk surface, including wet and dry slip resistance, before the area is opened to traffic. Rework any unsuitable areas.
- j. Leave work complete and ready for final inspection by Contracting Officer.

### End of Section

## SECTION 04 21 13.13

### NONBEARING MASONRY VENEER

#### PART 1 GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)	
AATCC 127	(2008) Water Resistance: Hydrostatic Pressure Test
AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)	
AISC 325	(2005) Steel Construction Manual
AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)	
ASHRAE FUN IP	(2009; Errata 2010) Fundamentals Handbook, I-P Edition
AMERICAN WELDING SOCIETY (AWS)	
AWS D1.3/D1.3M	(2008; Errata 2008) Structural Welding Code - Sheet Steel
APA - THE ENGINEERED WOOD ASSOCIATION (APA)	
APA PS 1	(1995) Voluntary Product Standard for Construction and Industrial Plywood
ASTM INTERNATIONAL (ASTM)	
ASTM A 123/A 123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 36/A 36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A 653/A 653M	(2009a) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 82/A 82M	(2007) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM C 1002	(2007) Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
ASTM C 1072	(2010) Standard Test Method for Measurement of Masonry Flexural Bond Strength
ASTM C 1177/C 1177M	(2008) Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C 1396/C 1396M	(2009a) Standard Specification for Gypsum Board
ASTM C 216	(2010) Facing Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 270	(2010) Standard Specification for Mortar for Unit Masonry
ASTM C 494/C 494M	(2010a) Standard Specification for Chemical Admixtures for Concrete

ASTM C 578	(2010) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(2009) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 665	(2006) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 67	(2009) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C 744	(2010) Prefaced Concrete and Calcium Silicate Masonry Units
ASTM C 780	(2009) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C 90	(2009) Loadbearing Concrete Masonry Units
ASTM C 91	(2005) Masonry Cement
ASTM C 954	(2010) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
ASTM C 955	(2009a) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
ASTM D 1056	(2007) Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1330	(2004) Rubber Sheet Gaskets
ASTM D 1667	(2005) Flexible Cellular Materials - Poly (Vinyl Chloride) Foam (Closed-Cell)
ASTM D 1777	(1996; R 2007) Thickness of Textile Materials
ASTM D 2103	(2010) Standard Specification for Polyethylene Film and Sheeting
ASTM D 5261	(2010) Measuring Mass Per Unit Area of Geotextiles
ASTM D 774/D 774M	(1997; R 2007) Bursting Strength of Paper
ASTM E 84	(2010b) Standard Test Method for Surface Burning Characteristics of Building Materials

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL

### PROCEDURES:

- SD-02 Shop Drawings
  - Detail Drawings
- SD-04 Samples
  - Expansion Joint Materials
  - Clay or Shale Brick
  - Concrete Masonry Unit
  - Prefaced Concrete Masonry Unit
  - Sample Panel
- SD-06 Test Reports
  - Calculations

## SD-07 Certificates

- Clay or Shale Brick
- Concrete Masonry Unit
- Joint Reinforcement
- Expansion Joint Materials
- Insulation
- Exterior Sheathing
- Moisture Barrier
- Vapor Retarder
- Veneer Anchors
- Welding

## 1.3 QUALITY ASSURANCE

### 1.3.1 Sample Panel

After the material samples are approved and prior to starting masonry work, build a sample masonry panel on the project site where directed. The sample panel shall be not less than 6 feet long by 4 feet high of typical wall thickness for the construction represented. The panel shall show color range, texture, bond pattern, expansion joints, and cleaning of the masonry as required in the work. The panel shall also show cold-formed steel framing, insulation, gypsum wallboard, gypsum sheathing, moisture barrier, vapor barrier, veneer anchors, joint reinforcement, steel shelf angles, flashing and weep holes. Use the approved sample panel as a standard of workmanship required in the actual installation; protect the sample panel from weather and construction operations. Do not remove the panel until the masonry veneer/steel stud wall work has been completed and accepted. Also submit a portable panel, approximately 2 by 2 feet, containing approximately [24 brick facings] [24 concrete masonry units] to establish the range of color and texture. One of each type of masonry veneer anchor used.

### 1.3.2 Efflorescence Tests

Perform efflorescence tests by an approved commercial testing laboratory. Sampling for the tests shall be the responsibility of the Contractor. Sample and test brick for efflorescence in accordance with ASTM C 67 and the rating shall be: "not effloresced".

### 1.3.3 Detail Drawings

Submit details of cold-formed steel framing and support around openings, including framing connections, steel lintels, steel shelf angles, attachment to other building elements and bridging. Drawings shall indicate thickness, material, dimensions, protective coatings, and section properties of all steel lintels and shelf angles used in exterior wall framing. Drawings shall also indicate size and type of all fasteners including size and type of all welds.

## 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver cementitious materials in unopened containers plainly marked and labeled with manufacturer's names and brands. Store cementitious materials in dry, weather-tight enclosures or covers. The masonry products shall be stored off the ground and protected from inclement weather. Materials shall be delivered and handled avoiding chipping, breakage, bending or other damage, and contact with soil or other contaminating materials. Store sand and other aggregates preventing contamination or

segregation and under a weather-tight covering permitting good air circulation. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content galvanizing repair paint whenever necessary to prevent the formation of rust. Store insulation, moisture barrier, and gypsum sheathing in dry, well ventilated, weather-tight areas protected from sunlight and excessive heat. Air infiltration type vapor barrier shall be stored in accordance with the manufacturer's recommendations.

## PART 2 PRODUCTS

### 2.1 VENEER WYTHE

Submit certificates stating that the materials and welders meet the requirements specified. Each certificate shall be signed by an authorized certification official and shall include their organization and position and shall identify the products covered under their certifying signature. The source of masonry materials which will affect the appearance of the finished work shall not be changed after the work has started except with the Contracting Officer's approval.

- a. The dimensions indicated on the drawings shall not be altered to accommodate inch-pound masonry products either horizontally or vertically. The 100 mm building module shall be maintained, except for the actual physical size of the masonry products themselves.
- b. Mortar joint widths shall be maintained as specified.
- c. Indicated reinforcing bar spacing shall not be exceeded. Inch-pound masonry products shall accommodate reinforcing bar placement. Reinforcing bars shall not be cut, bent or eliminated to fit into the inch-pound masonry product modules.
- d. Masonry inch-pound products shall not be reduced in size by more than one-third (1/3) in height and one-half (1/2) in length. Masonry products shall not be cut at ends of walls, corners, and other openings.
- e. Cut, exposed masonry products shall be held to a minimum and shall be located where they will have the least impact on the aesthetics of the facility.
- f. Other building components built into the masonry products, such as window frames, door frames, louvers, fire dampers, etc., that are required to be metric, shall remain metric.
- g. Additional metric guidance shall conform to Section 00 31 10 METRIC MEASUREMENTS.

#### 2.1.1 Clay or Shale Brick



Clay or shale brick veneer shall be masonry units conforming to ASTM C 216, Type FBS. Color range and texture shall be as indicated and conforming to the approved sample. Use grade SW for all brickwork. Brick unit sizes shall be standard.

## 2.2 MORTAR

Provide mortar conforming to ASTM C 270, Type S Mortar mix shall be based on proportion specifications. Laboratory testing of mortar shall be in accordance with the preconstruction evaluation of mortar section of ASTM C 780. Cement shall have a low alkali content and be of one brand. Provide aggregates from one source.

### 2.2.1 Masonry Cement

Masonry cement, in conformance with ASTM C 91, may be used in the mortar. When using a masonry cement, perform a comparative test between a portland cement-lime mortar and the masonry cement mortar proposed for the project to evaluate the ASTM C 1072 bond and the ASTM C 780 compressive strength of the two mixes. Conduct the test with the proposed masonry units for the project. The masonry cement mortar will be acceptable if the bond and compressive strength values are equal to or higher than the portland cement-lime mix. Limit the air-content of the masonry cement to 12 percent maximum.

### 2.2.2 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixtures shall be non-corrosive, contain less than 0.2 percent chlorides, and conform to ASTM C 494/C 494M, Type C.

## 2.3 JOINT REINFORCEMENT

Provide joint reinforcement of steel wire conforming to ASTM A 82/A 82M. Fabrication shall be by welding. Tack welding will not be permitted. Reinforcement shall be zinc-coated after fabrication in accordance with ASTM A 153/A 153M, Class B-2. Joint reinforcement shall consist of at least 1 continuous longitudinal wire in the veneer wythe. Minimum wire cross section shall be 0.017 square inches.

### 2.8.4 Joint Tape

Tape for sealing the joints in the vapor retarder shall be laminated tape with pressure sensitive adhesive as recommended by the manufacturer of the polyethylene film.

## 2.9 VENEER ANCHORS

Anchor assemblies for the attachment of the masonry veneer to the cold-formed steel framing, structural steel and/or concrete beam and column members, and concrete floor slabs [shall be as shown.] [shall be designed for the design loadings shown. Anchors shall transfer the design loadings from the masonry veneer to the cold-formed steel framing system or other support without exceeding

the allowable stresses and deflections in the anchors.] Length of anchor wires shall be such that the outermost wires lie between 1-1/4 inch from each face of the masonry veneer. Provide anchor wires without drips. Wires for veneer anchors shall be rectangular or triangular hoops formed from 3/16 inch diameter steel wire conforming to ASTM A 82/A 82M. Anchor assemblies, including wires and anchor plates, shall be hot-dip galvanized conforming to ASTM A 153/A 153M, Class B-2. The veneer anchor shall have a minimum capacity of [200] [\_\_\_\_\_] pounds. The load-displacement capacity of each veneer anchor, both in direct pull-out for tension and compression, shall be not less than 2000 pounds/inch (or a deflection of 0.05 inches/100 pounds of load in tension or compression). In the direction perpendicular to the masonry veneer, the anchor assembly shall have a maximum play of 1/16 inch.

#### 2.9.1 Adjustable Pintle-Eye Type Wire Anchors

Adjustable pintle-eye type wall anchors shall be two pieces rectangular type double pintle anchors.

#### 2.9.2 Dovetail Anchors

Dovetail slots are specified in Section [03 30 00.00 10 CAST-IN-PLACE CONCRETE] [03 30 00 CAST-IN-PLACE CONCRETE].

### 2.10 CONNECTIONS

Screws, bolts and anchors shall be hot-dip galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate.

#### 2.10.1 Framing Screws, Bolts and Anchors

Screws, bolts and anchors used in the assembly of the cold-formed steel framing system shall be [as shown.] [as required by design of the framing system for the specified loading.] Screw, bolt and anchor sizes shall be shown on the detail drawings.

#### 2.10.2 Welding

Design welded connections and perform all welding in accordance with AWS D1.3/D1.3M. Welders shall be qualified in accordance with AWS D1.3/D1.3M. All welds shall be cleaned and touched-up with zinc-rich paint.

#### 2.10.3 Veneer Anchor Screws

Screws for attachment of the veneer anchors to the cold-formed steel framing members shall be [No. 12.] [as shown.] [as required by design to provide the needed pullout load capacity but not less than No. 12.] Show screws on the detail drawings. The length of screws shall be such that the screws penetrate the holding member by not less than 5/8 inch.

### 2.12 EXPANSION JOINT MATERIALS

Expansion joint materials shall be bellows or U-shaped type conforming to Section 07 57 13 FLASHING AND SHEET METAL. Premolded type shall be closed-cell cellular rubber conforming to ASTM D 1056 or closed-cell vinyl or polyvinyl chloride conforming to ASTM D 1667.

## 2.13 FLASHING

Copper or stainless steel flashing shall conform to the requirements in Section 07 57 13 FLASHING AND SHEET METAL. Flashing shall be supplied in a continuous sheet extending from the exterior sheathing across the cavity and through the masonry veneer as shown.

## 2.14 STEEL LINTELS AND SHELF ANGLES

Steel shapes used for lintels and shelf angles shall conform to ASTM A 36/A 36M. Provide lintels and shelf angles as shown. These steel members shall be hot-dip galvanized in accordance with ASTM A 123/A 123M.

## 2.15 CAULKING AND SEALANTS

Caulking and sealants shall be as specified in Section 07 92 00 JOINT SEALANTS.

# PART 3 EXECUTION

## 3.1 GENERAL INSTALLATION REQUIREMENTS

Wall sections, types of construction and dimensions shall be as shown. Metal door and window frames and other special framing shall be built and anchored into the wall system as indicated. Submit Calculations demonstrating the structural adequacy of steel lintels and shelf angles for the calculated gravity loads being supported; this analysis shall be in accordance with AISC 325. Test results demonstrating that the veneer anchors are structurally adequate to resist the specified loadings shall be submitted for approval. Calculations demonstrating the insulation shown on the drawings provides the specified U-value for heat transmission of the completed exterior wall construction; this analysis shall be in accordance with ASHRAE FUN IP. Manufacturer's descriptive data and installation instructions for the insulation, the vapor barrier and the moisture barrier..

## 3.3 STEEL SHELF ANGLES

Unless otherwise shown, steel shelf angles shall be provided in segments that do not exceed 10 feet in length. At building corners, shelf angle segments shall be mitered and securely attached together by welding with legs no less than 4 feet where possible. Shelf angle segments shall not be connected together but instead shall be installed with 1/4 inch wide gaps between the segments. Fabrication and erection tolerances shall be in accordance with the AISC Code of Standard Practice, as indicated in AISC 325.

## 3.8 VENEER ANCHORS

Attach veneer anchors with screws through the sheathing and rigid insulation to the steel studs or other support members at the locations shown. When rigid insulation is used, the method of connecting the

veneer anchor through the insulation shall be approved by the Contracting Officer. Install veneer anchors with the outermost wires lying between 5/8 inch from each face of the masonry veneer. Use synthetic rubber washers between the anchor connector plates and the moisture barrier. Use a clutch torque slip screw gun on screws attaching veneer anchors to cold-formed steel members. Veneer anchors with corrugated sheet metal or wire mesh members extending across the wall cavity shall not be used. There shall be one veneer anchor for each two square feet of wall and shall be attached to steel studs and other supports with a maximum spacing of 24 inches on center. For pintle-eye anchors the vertical distance between the pintle section horizontal wires and the eye section horizontal wires shall not exceed 1/2 inch. Install dovetail slots as specified in the Section [03 30 00.00 10 CAST-IN-PLACE CONCRETE][03 30 00 CAST-IN-PLACE CONCRETE].

### 3.9 FLASHING

Provide continuous flashing at the bottom of the wall cavity just above grade. Flashing shall also be provided above and below openings at lintels and sills, at shelf angles, and as indicated on the drawings. Flashing shall be as detailed and as specified in Section 07 57 13 FLASHING AND SHEET METAL. Flashing shall be lapped a minimum of 6 inches at joints and shall be sealed with a mastic as recommended by the flashing manufacturer. Ends over doors, windows and openings shall be turned up and secured. Flashing shall be lapped under the moisture barrier a minimum of 6 inches and securely attached to the gypsum sheathing. Flashing shall extend through the exterior face of the masonry veneer and shall be turned down to form a drip.

### 3.10 MASONRY VENEER

Construct exterior masonry wythes to the thickness indicated on the drawings. A cavity consisting of a 2 inch minimum width air space will be provided between the moisture barrier and the masonry veneer. Masonry veneer shall not be installed until the exterior sheathing, moisture barrier, veneer anchors and flashing have been installed on the cold-formed steel framing system. Take extreme care to avoid damage to the moisture barrier and flashing during construction of the masonry veneer. Any portion of the moisture barrier and flashing that is damaged shall be repaired or replaced prior to completion of the veneer. Masonry [shall be placed in running bond pattern.] [shall be placed in stacked bond pattern. Longitudinal reinforcement consisting of at least one continuous galvanized steel wire shall be placed in the veneer wythe. The minimum wire size shall be 9 gauge.] [bond pattern shall be as indicated on the drawings.] Vertical joints on alternating courses shall be aligned and kept vertically plumb. Solid masonry units shall be laid in a non-furrowed full bed of mortar, beveled and sloped toward the center of the wythe on which the mortar is placed. Units shall be shoved into place so that the vertical mortar joints are completely full and tight. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned and relaid. Remove mortar which protrudes more than 1/2 inch into the cavity space. Provide means to ensure that the cavity space is kept clean of mortar droppings and other loose debris. Chases and raked-out joints shall be kept free from mortar and debris. Faces of units used in finished exposed areas shall be free from chipped edges, material texture or color defects or other imperfections distracting from the appearance of the finished work.

#### 3.10.1 Surface Preparation

Surfaces on which masonry is to be laid shall be cleaned of laitance or other foreign material. No units having a film of water shall be laid.

#### 3.10.2 Hot Weather Construction

Temperatures of masonry units and mortar shall not be greater than 120 degrees F when laid. Masonry erected when the ambient air temperature is more than 99 degrees F in the shade and when the relative humidity is less than 50 percent shall be given protection from the direct exposure to wind and sun for 48 hours after the installation.

### 3.10.3 Cold Weather Construction

Temperatures of masonry units and mortar shall not be less than 40 degrees F when laid. When the ambient air temperature is 32 degrees F or less, masonry veneer under construction shall be protected and maintained at a temperature greater than 32 degrees F for a period of 48 hours after installation. Submit for approval the proposed method of maintaining the temperature within the specified range prior to implementation. No units shall be laid on a surface having a film of frost or water.

### 3.10.4 Tolerances

Masonry shall be laid plumb, level and true to line within the tolerances specified in TABLE 1. All masonry corners shall be square unless otherwise indicated on the drawings.

TABLE 1

Variation From Plumb

---

In adjacent units	1/8 inch
In 10 feet	1/4 inch
In 20 feet	3/8 inch
In 40 feet or more	1/2 inch

Variation From Level Or Grades

---

In 10 feet	1/8 inch
In 20 feet	1/4 inch
In 40 feet or more	1/2 inch

Variation From Linear Building Lines

---

In 20 feet	1/2 inch
In 40 feet or more	3/4 inch

Variation From Cross Sectional Dimensions Of Walls

---

Plus	1/2 inch
Minus	1/4 inch

### 3.10.5 Mixing of Mortar

Mix mortar in a mechanically operated mortar mixer for at least 3 minutes but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Measurement of sand shall be accomplished by the use of a container of known capacity or shovel count based on a container of known capacity. Mix water with the dry ingredients in sufficient amount to produce a workable mixture which will adhere to the vertical surfaces of the masonry units. Mortar that has stiffened because of loss of water through evaporation shall be rettempered by adding water to restore the proper consistency and workability. Discard mortar that has reached its initial set or that has not been used within [2-1/2] [\_\_\_\_\_] hours.

### 3.10.6 Cutting and Fitting

Wherever possible, use full units in lieu of cut units. Where cut units are required to accommodate the design, cutting shall be done by masonry mechanics using power masonry saws. Wet-cut units shall be dried to the same surface-dry appearances of uncut units before being placed in the work. Cut edges shall be clean, true and sharp. Openings to accommodate pipes, conduits, and other accessories shall be neatly formed so that framing or escutcheons required will completely conceal the cut edges. Insofar as practicable, all cutting and fitting shall be accomplished while masonry work is being erected.

### 3.10.7 Masonry Units

When being laid, masonry units shall have suction sufficient to hold the mortar and to absorb water from the mortar, but shall be damp enough to allow the mortar to remain in a plastic state to permit the unit to be leveled and plumbed immediately after being laid without destroying bond. Masonry units with frogging shall be laid with the frog side down and better or face side exposed to view. Masonry units that are cored, recessed or otherwise deformed may be used in sills or in other areas except where deformations will be exposed to view.

### 3.10.8 Mortar Joints

Mortar joint widths shall be uniform and such that the specified widths are maintained throughout. Joints shall be of thickness equal to the difference between the actual and nominal dimensions of the masonry units in either height or length but in no case shall the joints be less than 1/4 inch nor more than 1/2 inch wide. Joints shall be tooled slightly concave. Tooling shall be accomplished when mortar is thumbprint hard and in a manner that will compress and seal the mortar joint and produce joints of straight and true lines free of tool marks.

### 3.10.9 Joint Reinforcement

Unless otherwise shown, space joint reinforcement at 16 inches on center vertically. Joint reinforcement shall not be placed in the same masonry course as veneer anchors unless the anchors are designed to accommodate the wire. Place joint reinforcement so that longitudinal wires are centered in the veneer wythe for solid units. Longitudinal wires shall be fully embedded in mortar for their entire length. Splices in joint reinforcement shall be lapped a minimum of 6 inches. Joint reinforcement shall be discontinuous at all veneer joints. The minimum cover for joint reinforcement is 5/8 inches.

### 3.10.10 Veneer Joints

Provide [brick expansion joints] [and] [concrete masonry veneer joints] at the locations shown on the drawings. Details of joints shall be as indicated on the drawings. Joints shall be clean and free of mortar and shall contain only backer rod and sealant, installed in accordance with Section 07 92 00 JOINT SEALANTS. Horizontal reinforcement shall not extend through the joints.

### 3.10.11 Weep Holes

Provide weep holes at all flashing locations at intervals of [24] [16] inches. Place weep holes in head joints just above the flashing. Weep holes shall be formed by leaving head joints open or head joint vents may be used. Keep weep holes free of mortar and other obstructions.

### 3.10.12 Head Joint Vents

Provide head joint vents near the top of the veneer wythe at the same spacing as the weep holes.

### 3.10.13 Discontinuous Work

When necessary to temporarily discontinue the work, step back the masonry for joining when work resumes. Tothing may be used only when specifically approved. Before resuming work, loose mortar shall be removed and the exposed joint shall be thoroughly cleaned. Top of walls subjected to rain or snow shall be covered with nonstaining waterproof covering or membrane when work is not in process. Covering shall extend a minimum of 2 feet down on each side of the wall and shall be held securely in place.

### 3.10.14 Cleaning

Completely remove mortar daubs or splashings from finished exposed masonry surfaces before they harden or set up. Before completion of the work, defects in mortar joints shall be raked out as necessary, filled with mortar, and tooled to match the adjacent existing mortar in the joints. The proposed cleaning method shall be done on the sample wall panel and the sample panel shall be examined for discoloration or stain. If the sample panel is discolored or stained, change the method of cleaning to ensure that the masonry surfaces in the structure will not be adversely affected. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Cleaning shall be accomplished with the use of stiff bristle fiber brushes, wooden paddles, wooden scrapers, or other suitable nonmetallic tools. [The exposed brick surfaces shall be saturated with water and cleaned with a proprietary brick cleaning agent recommended by the clay products manufacturer. The cleaning agent shall not adversely affect the brick masonry surfaces. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations.] [Concrete masonry unit surfaces shall be dry-brushed at the end of each day's work after any required pointing has been done.] Remove efflorescence or other stains in conformance with the recommendations of the masonry unit manufacturer. After construction and cleaning, masonry surfaces shall be left clean, free of mortar daubs, stain, and discolorations, including scum from cleaning

operations, and will have tight mortar joints throughout. Metallic tools and brushes shall not be used for cleaning.

### 3.11 BUILDING EXPANSION JOINTS

Locate expansion joints where indicated and made of the size and details shown.

**End of Section**



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

**PART-1 GENERAL**

**1.1 INCLUDED**

Provide fabrication and erection of structural steel and other items as shown on the drawings or required by other sections of these specifications. Provide inspector to inspect bolts and welds during steel erection.

**1.2 PUBLICATIONS**

Industry publications controlling the work of this section include:

**1.2.1 American Institute of Steel Construction (AISC)**

Manual of Steel Construction, Allowable Stress Design (ASD).

**1.2.2 American Society for Testing and Materials (ASTM)**

ASTM A36-90	Structural Steel.
ASTM A53-90a	Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless.
ASTM A108-90a	Steel Bars, Carbon, Cold Finished, Standard Quality.
ASTM A123-89a	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
ASTM A307-90	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
ASTM A325-90	High-Strength Bolts for Structural Steel Joints.
ASTM A490-90	Heat-Treated, Structural Steel Bolts, 150 (KSI) (1035MPa) Tensile Strength.
ASTM A500-90	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
ASTM A563-90	Carbon and Alloy Steel Nuts.
ASTM A572/ A772M	Standard Specification for High-Strength Low-Alloy Columbium Vanadium Structural Steel
ASTM A780-80	Standard Practice for Repair of Damaged Hot-Dip Galvanized Coatings.
ASTM B695-91	Coatings of Zinc Mechanically Deposited on Iron and Steel.
ASTM F436-90	Hardened Steel Washers.
ASTM F959-90	Compressible-Washer-Type Direct Tension Indicator for Use with Structural Fasteners.

**1.2.3 American Welding Society (AWS)**

AWS A5.1	Covered Carbon Steel Arc Welding Electrodes.
AWS A5.5	Low Alloy Steel Covered Arc Welding Electrodes.

AWS C2.2-67	Recommended Practices for Metalizing with Aluminum and Zinc for Protection of Iron and Steel.
AWS D1.1	Structural Welding Code - Steel.

**1.2.4 Research Council on Structural Connections (RCSC)**

"Specifications for Structural Joints Using ASTM A325 Bolts or ASTM A490 Bolts," as endorsed by AISC.

**1.2.5 Steel Structures Painting Council (SSPC)**

SSPC-SP3                      Power Tool Cleaning.

**1.3 SUBMITTALS**

Parsons WRPM approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Fabrication and erection drawings showing all details, connections, material designations, and all top of steel elevations.

**1.4 QUALITY ASSURANCE**

Welders shall be qualified as prescribed in AWS D1.1.

**PART-2 PRODUCTS**

**2.1 STRUCTURAL STEEL**

Structural shapes, plates, bars, tubing and steel pipe shall conform to the following specifications:

**2.1.1 Angles, channels, plates and bars**

Conform to ASTM A36.

**2.1.2 Wide flange**

Conform to ASTM A572.

**2.1.3 Structural tubing**

Conform to ASTM A500, Grade B.

**2.1.4 Steel pipe**

Conform to ASTM A53, Type E or S, Grade B.

**2.2 ANCHOR BOLTS**

Conform to ASTM A307 with heavy hexagonal nuts.

**2.3 BOLTS**

- A. Bolts shall be High strength bolts and shall conform to ASTM A325. One high strength bolt assembly shall consist of a heavy hex head structural bolt, a heavy hex nut, a hardened washer conforming to ASTM F436 and

a direct tension indicator conforming to ASTM F959. The hardened washer shall be installed against the element turned in tightening.

## 2.4 WELDING ELECTRODES

Welding electrodes shall comply with AWS D1.1 using AWS A5.1 or AWS A5.5 E70XX and shall be compatible with the welding process selected.

## 2.5 LOCKNUT

For use with other than high strength bolts.

- A. **Alternate 1:** "Palnuts" as manufactured by Palnut Company of Irvington, NJ, or approved equal.
- B. **Alternate 2:** "Anco Lock Nut" as manufactured by Automatic Nut Co. of Lebanon, PA, or approved equal, in lieu of the regular hex nut and the locknut.

## 2.6 PRIMER

Primer shall be a red oxide-chromate primer complying with SSPC Paint Specification No. 11.

# PART-3 EXECUTION

## 3.1 FABRICATION

Shop fabricate and assemble materials as specified herein.

- A. Fabricate items of structural steel in accordance with the AISC-ASD Specifications, and as indicated on the approved shop drawings.
- B. Properly mark and match-mark materials for field assembly and for identification as to location for which intended.
- C. Fabricate and deliver in a sequence which will expedite erection and minimize field handling of materials.
- D. Where finishing is required, complete the assembly, including welding of units, before start of finishing operations.
- E. Provide finish surfaces of members exposed in the final structure free from markings, burrs, and other defects.
- F. Provide connections as specified herein.
  - a. Provide bolts and washers of types and sizes required for completion of field erection.
  - b. Install high strength threaded fasteners in accordance with RCSC "Specifications for Structural Joints Using ASTM A325 or ASTM A490 Bolts."
  - c. Welded construction shall comply with AWS D1.1 for procedures, appearance, quality of welds, and methods used in correcting welded work.
  - d. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.
  - e. All connections which are not detailed or otherwise noted on the design drawings shall be shop welded and field bolted in accordance with AISC Framed Beam Connections, Tables II and III as shown in the AISC-ASD Manual of Steel Construction. Use the maximum number (n) rows of

field bolts compatible with a beam T dimension and flange cope for each beam depth under consideration. Use a 1/4-inch shop weld "A" shown in Table III for the required number of field bolts. All bolted connections shall consist of a minimum of 2 bolts and be capable of withstanding a minimum shear and tension load of 6000 pounds.

- f. The fabricator shall furnish and install erection clips for fit-up of welded connections.
- g. Double angle members shall have welded fillers spaced in accordance with Chapter E4 of the AISC-ASD Specification.

### **3.2 PLATES**

Gusset and stiffener plates shall be 3/8-inch thick minimum.

### **3.3 COLUMNS**

Columns shall have full bearing at splices and at end plates.

### **3.4 CAMBER**

All members shall be fabricated with natural camber up.

### **3.5 SHOP PRIMING**

Structural steel shall be shop primed as specified herein, unless shown otherwise on the drawings.

- A. Structural steel surface preparation shall conform to SSPC-SP3, "Power Tool Cleaning."
- B. Surface preparation and primer application shall be in accordance with AISC Code of Standard Practice as included in the ASD Manual of Steel Construction.
- C. Storing, thinning, mixing, handling, and application of paint materials shall be in accordance with manufacturer's instructions. Containers shall remain closed until required for use. Manufacturer's pot-life requirements shall be strictly adhered to.
- D. Primer shall be applied to dry, clean, prepared surfaces and under favorable conditions in accordance with manufacturer's instructions. Unless otherwise recommended by manufacturer, priming shall not be done when the ambient temperature is less than 50°F, the relative humidity is more than 90 percent, or the surface temperature is less than 5°F above the dew point.
- E. Generally, all primer shall be spray applied. Brush or roller application shall be restricted to touch-up and to areas not accessible by spray gun.
- F. Primer shall be uniformly applied without runs, sags, solvent blisters, dry spray or other blemishes. All blemishes and other irregularities shall be repaired or removed and the area recoated. Special attention shall be paid to crevices, weld lines, bolt heads, corners, edges, etc., to obtain the required nominal film thickness.
- G. The dry film thickness of the primer shall be 2.0 mils.
- H. If primer is damaged by welding or physical abuse, the area shall be touched-up and repaired. The touch-up paint shall be compatible with the applied primer with minimum dry film thickness of 1.5 mils.
- I. All primers and touch-up paint shall be applied in strict accordance with the manufacturer's instructions and these specifications.

### 3.6 GALVANIZING

All galvanizing shall be as specified herein.

- A. When indicated on the drawings, structural steel including handrail, ladder, stairway, treads, grating, checkered plate, bolts, nuts and washers shall be galvanized in accordance with this Section and the applicable ASTM Standards.
- B. Galvanizing of structural steel shapes, plates, bars and strips shall be in accordance with ASTM A123. Minimum weight of zinc coating shall be 2.0 oz/ft<sup>2</sup> for individual specimen and minimum thickness of 3.4 mils.
- C. When specified on drawings, all bolts, nuts and washers shall be mechanically zinc coated in accordance with ASTM B695, Type I. Nuts shall be tapped oversize in accordance with ASTM A563 prior to zinc coating and need not be retapped after coating.
- D. The fabricator shall be responsible to safeguard against embrittlement and warpage.
- E. Whenever practical, cutting, drilling and welding shall be performed prior to galvanizing.

### 3.7 REPAIRING DAMAGED HOT-DIP GALVANIZED COATINGS

When approved by the PM Designee, hot-dip galvanized coatings shall be repaired as follows:

- A. All damaged hot-dip galvanized coatings of reamed or field-drilled holes shall be repaired using a zinc-rich paint.
  - a. As a minimum, the zinc-rich paint dried film shall contain 94% zinc dust by weight, and shall conform to ASTM A780-80.
  - b. Minimum dry film thickness is 3 mils.
  - c. Acceptable products include Z.R.C. liquid cold galvanizing compound with shiny finish, by ZRC Products Company, or previously approved alternate.
- B. All other damaged galvanized coatings shall be repaired using a metalizing/thermal spray coating process per AWS C2.2-67.
  - a. Use a metalizing alloy composed of 85% zinc and 15% aluminum.
  - b. Minimum coat thickness shall be 6 mils. Dry film thickness shall be measured by using a magnetic or electromagnetic gage. Measurements shall be taken in the presence of the PM Designee at locations selected by him.

#### 3.7.1 Surface Preparation

- A. Surfaces to be reconditioned shall be clean, dry, and free of oil, grease, and corrosive products.
- B. Surface preparation shall be in accordance with ASTM A870 and AWS C2.2-67.
- C. To ensure a smooth coating, surface preparation shall extend into the undamaged galvanized coating. The method and extent of surface preparation shall be approved by the PM Designee.

**END OF SECTION**

**SECTION 05 12 00.10**  
**STRUCTURAL STEEL ERECTION**

**PART-1 GENERAL**

**1.1 WORK INCLUDED**

Furnish all labor and materials, equipment and incidentals necessary to erect structural steel and miscellaneous metals.

**1.2 QUALITY ASSURANCE:**

**A. Testing:**

1. All shop welds shall be visually inspected and physically tested. Full penetration shop and field welds shall be non-destructive tested by radiographic, ultrasonic, magnetic particle or dye penetrant methods in accordance with AWS B1.10 as approved by the Subcontract Administrator. Tubular constructions shall be inspected by ultrasonic methods, Class R. All test methods and procedures used shall be determined by the PM Designee in advance of welding.
2. Welding shall be inspected by an independent testing agency selected by the Subcontract Administrator and whose services shall be paid by the Government. The testing agency is the representative of the Government and the Subcontractor shall make all facilities available for inspection at all times, including Shop Fabrication. Inspection of welding shall be in conformance with AWS D1.1 "Structural Welding Code Steel".
3. High Strength Bolts in connections shall be inspected by Government's testing agency in accordance with AISC "Specification for Structural Joints using ASTM A-325 or A-490 Bolts". Records shall be kept for all testing and shall show date of inspection, location and type of weld, defects encountered and date of repairs.

**B. Re-inspection:** Subcontractor shall bear costs of re-inspection due to specification non-conformance discovered during tests.

**C. Welder's Qualification:**

1. Welds shall be made only by operators who have previously qualified by tests, as prescribed by the "Standard Qualification Procedure" in the "Structural Welding Code - Steel" by the American Welding Society to perform the type of work required. The Subcontractor shall provide certification that welders have passed qualification test within six months just prior to performance of work.
2. The techniques of welding employed, the appearance and quality of welds made, and methods used in correcting defective work shall conform to Section 4, "Technique" of the Current Edition of the "Structural Welding Code - Steel" by the American Welding Society.

**1.3 SUBMITTALS:**

Submittals shall be in accordance with Section 01330 SUBMITTALS and shall include the following:

- A.** Certificate of Welder's qualification
- B.** Schedule of Time Schedule for Shop fabrication

- C. Erection Schedule and Description of Erection Procedures
- D. Setting Bolt and Anchor Plate Templates.

#### 1.4 REFERENCES AND STANDARDS:

The applicable provisions of the following references and standards are hereby made a part of this Section as if written herein in their entirety:

- A. **American Institute of Steel Construction (AISC) Publications:** "Specifications for Structural Steel Buildings"
- B. **American Welding Society (AWS) Publication:** "Code for Arc and Gas Welding in Building Construction"
  - AWS D1.1 Structural Welding Code - Steel
  - AWS B1.10 Guide for Non-Destructive Inspection of Welds
  - AWS A5.1 Specification for Covered Carbon Steel Arc Welding Electrodes
  - AWS A5.5 Specification for Low Alloy Steel Covered Arc Welding Electrodes
- C. **Military Specification:** MIL-P-21035, High Zinc Dust Content, Galvanizing Repair.

#### 1.5 DELIVERY, HANDLING, AND STORAGE

Deliver steel members and fabricated components to site and store on wood runners or platform raised above grade level. Steel shall not come into contact with groundwater.

#### 1.6 JOB CONDITIONS:

- A. Erection of steel shall be in proper sequence with the work of other trades. Steel shall be erected in a reasonable sequence and shall be guyed and braced as erected.
- B. Obtain complete field dimension prior to fabrication of steel. Re-check dimensions as steel is erected. Report deficiencies or errors to the Subcontract Administrator in writing in sufficient time to allow for corrections to be made prior to continuing work.
- C. Obtain setting bolt templates and setting drawings and install bolts at exact location in the structure.
- D. Subcontractor is responsible for maintaining surveying instrument and developing a procedure that permits complete quality control of steel erection. Columns shall be plum and horizontal members shall be level.

#### PART-2 PRODUCTS

NOT USED

## **PART-3 EXECUTION**

### **3.1 ERECTION:**

- A.** The framing shall be carried up true and plumb and temporary bracing shall be introduced wherever necessary to take care of the loads to which the structure may be subjected, including erection equipment and its operation. Such bracing shall be left in place as long as may be required for safety. It shall finally be removed by the Subcontractor as part of his equipment. As erection progresses, the work shall be securely connected to take care of all dead load, wind, and erection stresses.
- B.** Set columns in exact position, in alignment, plumb and at proper elevations. Center of base plate shall be within 1/16 inch of true center line. Height shall be shimmed and grouted to 1/32 inch true height. Support base plate on leveling nuts until grouted and set.
- C.** Erection bolts used as temporary anchorage for fully welded joints shall be removed after welds are complete and approved. In visible locations holes shall be plug welded solid. Bolted connections using machine bolts shall be peened to deface threads after bolts have been tightened.
- D.** Furnish templates for setting anchor bolts or anchor plates that are to be cast into concrete. Furnish instructions for setting of anchors, connection details, length of exposed bolts, and other information necessary for the proper setting of embedded components.

### **3.2 BOLTED FIELD CONNECTIONS:**

- A.** Correction of mis-aligned holes at connections and base plates must be by methods approved by the Subcontract Administrator. Enlarged holes, when permitted, must be reamed to larger size. Do not burn holes to larger diameter. Mis-matched holes in any number makes the complete member subject to rejection without further comment.
- B.** ASTM A-325 high strength bolts shall have suitable identification mark on heads. Tightening of nuts shall be in accordance with AISC "Structural Joints using ASTM A-325 or A-490 Bolts". Minimum bolt tension for the size of bolt uses shall be in accordance with tables listed in referenced standards. Tightening shall be accomplished using "calibrated wrench" method.
- C.** When assembled, joint surfaces, including those adjacent to the washers, shall be free of scale except tight mill scale. They shall be free of dirt, loose scale, burrs, and other defects that would prevent solid seating of the parts. Contact surfaces with friction-type joints shall be free of oil, paint, lacquer or galvanizing.

### **3.3 WELDED FIELD CONNECTIONS:**

- A.** Each welder shall place his identification mark with paint (or stamp) near the welds he constructed, so that all weldments can be properly identified and associated with the correct welder.
- B.** Surfaces to be welded shall be free from loose scale, slag, rust, grease, paint, and any other foreign material except that mill scale withstanding vigorous wire brushing may remain. Joint surfaces shall be free from fins and tears. Preparation of edges by gas cutting shall, wherever practicable, be done by mechanically guided torch.
- C.** Clean tack welds and thoroughly fuse with final weld. Remove defective, cracked, or broken tack welds before final welding. Tack welds must be removed from joints where stress is primary, if welding is to be manual.



- D. Weld metal shall be completely sound and free of cracks in any weld or weld pass. Fill all craters to the full cross-section of the weld. Remove weld scale or slag, spatter, burrs, and other sharp or rough projections to leave the surface suitable for non-destructive testing, cleaning, and painting.
- E. Cut apart and reweld improperly fitted and misaligned parts. Remove cracked welds throughout their length.
- F. Straighten members distorted by heat of welding using mechanical means or by carefully supervised application of a limited amount of localized heat. Heated areas shall not exceed 1,200 degrees Fahrenheit as measured by Tempilsticks. Parts to be heated for straightening shall be free from external stress forces, except when mechanical means are used in conjunction with heat application.
- G. If faulty welding or its removal for rewelding damages the base metal so that, in the PM Designee's judgement, it is not in accordance with the intent of the drawings and specifications, remove and replace the damaged material and compensate for the deficiency in a manner acceptable to the PM Designee.
- H. Where work performed subsequently to the making of the deficient weld has rendered the weld inaccessible, or has caused new conditions which make connection of the deficiency dangerous or ineffectual, restore the original conditions by removing welds or members, or both before making the necessary corrections. Another option is to compensate for the deficiency with additional work according to the revised design, approved by the PM Designee.
- I. Beam flanges employing full penetration welds shall have 1-1/4" x 3/16" backup plate. Back gouge root pass and weld flush on backside of beam webs where full penetration is specified.
- J. Protect finish material from damage. Shield operations from wind currents. Do not perform welding operation during rainy weather or when temperature is below 40° degree F.
- K. Field weld joints which are to remain exposed shall be welded continuously regardless of strength requirements. Other joints may be skip welded as necessary to develop strength requirements. In all cases, connection shall be adequate to develop the full strength of largest member connected, regardless of actual requirements.

### 3.4 FIELD QUALITY CONTROL:

- A. Corrective measures shall be taken when welding is unsatisfactory or indicates inferior workmanship. Chip and grind if the removal of part of the weld or a portion of the base metal is required. Where deposition of additional weld material is necessary, the sides of the area to be welded shall have no less than one to one slope to allow room for depositing new material. Correct defective or unsound welds by the removal and replacement of the entire weld using the following procedures:
  1. Excessive Convexity: Remove excess weld metal by grinding.
  2. Shrinkage Cracks, Cracks in Base Metal, Craters and Excessive Porosity: Remove defective portions of base and weld material down to sound metal, and deposit additional sound material.
  3. Undercutting, Undersize, and Excessive Concavity: Clean and deposit additional weld metal.
  4. Overlapping and Incomplete Fusion: Remove and replace the defective portion of the weld.
  5. Slag Inclusion: Remove those parts of the welds containing slag. Fill with sound weld metal.
  6. Removal of Adjacent Base Metal during Welding: Clean and form full size by depositing weld material.

- B.** Field connections shall be visually inspected and physically tested as described above. Every connection must be identified by number and shall be approved by the PM Designee or Government's testing agency. Procedure for identifying faulty connections shall be determined by the PM Designee.

**3.5 FIELD PAINTING:**

- A.** Shop painting shall be in accordance with the individual section of the specification. Finished painting shall be as specified in Section 09 91 00 PAINTING. Apply one coat of paint to field welds, and bolts and as necessary to touch up damaged primer. Remove rust and apply same primer as specified.
- B.** Galvanized metals shall be repaired with a cold applied zinc-rich paint. Coat welds, bolts damage to galvanized surfaces, and surface cuts made in the field.

**3.6 CLEAN AND ADJUST:**

After inspection and approval, the steel work shall be thoroughly cleaned of loose scale, rust, splatter, slag, flux, deposit, oil, dirt, and other foreign matter. Exposed steel shall be painted as specified in Section 09 91 00 PAINTING.

**END OF SECTION**

**THIS PAGE INTENTIONALLY LEFT BLANK**

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

**PART-1 GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Metal fabrication requirements for structural members.
2. Miscellaneous materials

B. Products furnished, but not installed, under this Section:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

**1.2 SUBMITTALS**

Parsons WRPM approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.
3. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.

D. Welding certificates.

E. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

### **1.3 QUALITY ASSURANCE**

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

### **1.4 PROJECT CONDITIONS**

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

### **1.5 COORDINATION**

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

## **PART-2 PRODUCTS**

### **2.1 METALS, GENERAL**

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

### **2.2 FERROUS METALS**

- A. Steel Plates, Channels, Angles, and Bars: ASTM A 36/A 36M, Wide Flanges: ASTM A572
- B. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240 or ASTM A 666, Type 304.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

- D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- E. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- F. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

### 2.3 NON FERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- E. Bronze Plate, Sheet, Strip, and Bars: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper).
- F. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).
- G. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).
- H. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.
- I. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

### 2.4 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners. Select fasteners for type, grade, and class required.
  - 1. Provide stainless-steel fasteners for fastening aluminum.
  - 2. Provide stainless-steel fasteners for fastening stainless steel.
  - 3. Provide stainless-steel fasteners for fastening nickel silver.
  - 4. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

- E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
  - 1. Hot-dip galvanize.
- F. Eyebolts: ASTM A 489.
- G. Machine Screws: ASME B18.6.3.
- H. Lag Screws: ASME B18.2.1.
- I. Wood Screws: Flat head, ASME B18.6.1.
- J. Plain Washers: Round, ASME B18.22.1.
- K. Lock Washers: Helical, spring type, ASME B18.21.1.
- L. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- M. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- N. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
  - 2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

## 2.5 METAL CEILING SUPPORT SYSTEM

- A. Channels: Carbon steel, ASTM A570, Grade 33, 12 gage. Plain finish.
  - 1. Basis of Design: Unistrut Corporation, 1140 W. Thorndale Avenue, Itasca, IL 60143. Telephone: 800-223-6840.
- B. Fittings: Carbon steel, ASTM A575, Grade 60.
  - 1. Basis of Design: Unistrut Corporation.
- C. Screws and Nuts: Carbon steel, ASTM A307 and ASTM A675.

- D. Protective End Caps: Provide vinyl or plastic end caps on protruding channels to guard against personal injury or damage to clothing.
  - 1. Basis of Design: Unistrut Corporation Channel End Caps.

## 2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
  - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 4000 psi.

## 2.7 FABRICATIONS, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.



2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## **2.8 MISCELLANEOUS FRAMING AND SUPPORTS**

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
1. Fabricate units from slotted channel framing where indicated.
  2. Furnish inserts for units installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Galvanize miscellaneous framing and supports where indicated.
- E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

## **2.9 MISCELLANEOUS STEEL TRIM**

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

## **2.10 LOOSE BEARING AND LEVELING PLATES**

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates.
- C. Prime plates with zinc-rich primer.

## **2.11 LOOSE STEEL LINTELS**

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.
- D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

## **2.12 STEEL WELD PLATES AND ANGLES**

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

## 2.13 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

## 2.14 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
  - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - 1. Shop prime with universal shop primer.
- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## 2.15 ALUMINUM FINISHES

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

## **PART-3 EXECUTION**

### **3.1 INSTALLATION, GENERAL**

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

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

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.
- C. Support steel girders on concrete, or steel pipe columns. Secure girders with anchor bolts embedded in concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

### **3.3 INSTALLING BEARING AND LEVELING PLATES**

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
1. Use non-shrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations unless otherwise indicated.
  2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### **3.4 ADJUSTING AND CLEANING**

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

**END OF SECTION**

## SECTION 06 41 00 MILLWORK

### PART-1: GENERAL

#### 1.1 Description

- 1.1.1 Work of this Section, as shown or specified, shall be provided by the Interior Contractor and shall be in accordance with the requirements of the Contract Documents.
- 1.1.2 Work includes coordination, fabrication, and installation of all Millwork, wood cabinets, panelwork, counters, and shelving as shown on the drawings and as specified herein.
- 1.1.3 Related work in other Sections:
  - a. Casework - Section 12302
  - b. Finish Carpentry - Section 06200
  - c. Plastic Laminate - Section 06240
  - d. Glass and glazing - Section 08800
  - e. Metal - Section 12654
  - f. Wood - Section 12655

#### 1.2 Submittals

- 1.2.1 All submittals shall be made according to Section 01300 and as described herein.
- 1.2.2 Submit the following for each item of Millwork:
  - a. Shop Drawings, indicating fabrication and installation methods, to include plans and elevations at not less than 1/2" = 1'-0" (1:20) scale and details at not less than 3" = 1'-0" (1:5) scale. Indicate required anchorage and blocking, accessory items, field dimensions, materials and finishes. Indicate compliance with specification requirements
  - b. Manufacturer's Product Data for all specialty items not manufactured by the Millwork Fabricator.
  - c. Two samples of each species of specified wood, cut and finish. Samples shall be minimum 12" x 12" (300MM X 300MM) (or full member width and thickness) finished as specified on one face, one edge, and one end. Samples shall be fire-retardant treated wood where such has been specified or is required by code. Review will be for color and texture only; compliance with other requirements is responsibility of Interior Contractor. Samples of finishes shall be applied on the appropriate wood or base material as will occur in the final Millwork item when installed.
  - d. A minimum of three different flitches of any and all veneers specified shall be submitted to the Consultant for approval unless veneers have been previously selected by Consultant and herein specified. Flitches shall indicate the color, grain, texture, and finish range to be expected in the Project.

- e. Where variations in wood and finish may occur, a minimum of three variations showing extremes which may be expected of any and all wood finishes as specified shall be submitted to the Consultant for approval. Minimum size: 12" x 20" (300 MM X 500 MM).
- f. Where required by the Owner or Consultant, the Interior Contractor shall provide full size mock-up of panel or millwork assembly for approval.
- g. Interior Contractor shall submit to the Consultant three samples 20" (500MM) minimum length, of all mouldings and/or moulding assemblies to be used for the Project. These shall be full size and finished as specified in the Contract Documents.

### 1.3 Quality Assurance

1.3.1 Comply with applicable provisions for Premium Grade as defined in the latest edition of the AWI Quality Standards for all materials, fabrication and workmanship for all work of this Section.

1.3.2 All work of this Section shall be performed by skilled mechanics of the trade and shall be of the highest quality. Comply with applicable Industry Standards for all work and materials as specified. Such Industry Standards are to include but not be limited to the applicable provisions or standards of the following:

- a. American Society for Testing and Materials (ASTM):  
E-84-70: Test for Surface Burning Characteristics of Building Materials.
- b. Federal Specifications (FedSpec):  
FF-N-105B(2): Nails, Brads, Staples and Spikes: Wire Cut and Wrought  
  
FF-S-111C(1) Screws, Wood
- c. U.S. Department of Commerce: Product Standard (PS) 1-66 Softwood Plywood, Construction and Industrial Product Standard (PS) 20-70 American Softwood Lumber Standard.
- d. Architectural Woodwork Institute (AWI): Quality Standards and Guide Specification, latest edition. (Premium Grade)
- e. National Electrical Manufacturers Association (NEMA): LD-3-1975 Laminated Plastic Specification.
- f. National Hardwood Lumber Associate (NHLA).
- g. National Particleboard Association (NPA).
- h. American Plywood Association (APA) plywood grades:

- 1 . for softwood plywood: Product Standard PS-1
- 2 . for hardwood plywood: Product Standard PS- 51
- 1 . 3 . 3 The Interior Contractor shall be responsible for obtaining and complying with all Code and regulatory agencies for materials and methods. He shall also be responsible for obtaining permits and approvals.
- 1 . 3 . 4 The Interior Contractor shall be responsible for accurately obtaining all field dimensions related to his work prior to fabrication. Where discrepancies are found, he shall notify the Consultant immediately in writing.
- 1 . 3 . 5 All Millwork materials and completed Millwork shall be stored in a dry, ventilated place, protected from the weather and complying with the temperature and humidity conditions specified by AWI Quality Standards.
- 1 . 3 . 6 Protect sanded and finished surfaces from soiling and damage during handling and installation.
- 1 . 3 . 7 Maintain requirements for heating, cooling and ventilation in installation areas as required to reach relative humidity necessary to maintain optimum moisture content specified for Millwork by AWI Standards.
- 1 . 3 . 8 Provide temporary protection of all Millwork as required to protect work from damage.

## PART 2: PRODUCTS

### 2 . 1 Materials

- 2 . 1 . 1 All woodwork materials shall be new and shall conform to the Premium Grade requirements of the AWI Quality Standards, latest edition.
- 2 . 1 . 2 All lumber shall be kiln-dried to the average moisture content as recommended by the AWI Quality Standards, latest edition appropriate for the regional climatic conditions of the project site.
- 2 . 1 . 3 All solid wood elements shall be clear, straight-grain lumber of the best grade of specified species as listed by the NHLA. Lumber shall be free of any defects which might impair serviceability, aesthetics, and/or finish. Solid wood elements shall also be according to the following, unless indicated otherwise on drawings and/or specifications:
  - a . Specie of Face Woods receiving transparent finishes shall be as specified on the drawings and shall be selected for specified grain with uniform color and grain suitable for use with the finished plywood with which it is used.
  - b . Face Woods receiving opaque finishes shall be Birch, Poplar, or Custom Grade but otherwise shall have same specification as solid stock for Face Woods above.



- c . Unexposed woods shall be Custom Grade Poplar, kiln dried unexposed woods come into contact with drawers, they shall be Birch or Maple, unselect.
- 2 . 1 . 4 All veneer core elements shall be clear straight-grain lumber of the best grade of the specified species as listed by the N.H.L.A. Lumber shall be free of any defects which might impair serviceability, aesthetics, and/or finish. Where veneer differs on two sides, veneers shall be of similar thickness, density, and characteristics to prevent any warpage. Veneer core elements shall also be according to the following, unless indicated on drawings or specifications:
- a . Adhesives shall be water-resistant resin or approved equal; process shall be hot plate method using the following number of plys to achieve specified thickness:
    - 1 . 1/4" (6 mm) overall thickness shall be of 3- ply veneer core construction.
    - 2 . 3/8" (9 mm) overall thickness shall be of 5- ply veneer core construction.
    - 3 . 1/2" (12 mm) overall thickness shall be of 5-ply veneer core construction.
    - 4 . 3/4" (20 mm) overall thickness shall be of 7-ply veneer core construction.
    - 5 . 1" (25 mm) overall thickness shall be of 9- ply veneer core construction.
  - b . Where burl panels are specified core must be crossbanded with Poplar prior to applying burl veneer.
  - c . Provide Douglas or Poplar Fir V-type solid edge trim on all exposed edges of plywood not designated to be surfaced by plastic laminate.
  - d . For Face Woods receiving transparent finishes, Species shall be as specified on drawings; faces shall be selected and matched by the Interior Contractor/Vendor with respect to cutting lengths, uniformity of color, figure, and grain character. Face veneers shall not contain open joints, face depressions, glue stain or other manufacturing irregularities.
  - e . Face Woods receiving opaque finishes shall have custom grade (face veneer) Birch or Poplar, selected, but otherwise shall have same specification as Plywood for Face Woods (Paragraph 2.1.4.a).
  - f . Unexposed woods shall be Birch, Poplar or Douglas Fir, rotary cut, Unselect, good one side, interior type plywood, one side Grade A and one side Grade B; Grade A faces shall not contain plugs, knots, pitch pockets, splits, rough grain or other open defects.
  - g . Wood for plastic lamination shall be minimum 3/4" (20 mm) Mahogany face core plywood, good one side.
- 2 . 1 . 5 All particle board shall be resin impregnated wood flakes of high density construction as manufactured by U.S. Plywood Corporation, Shasta Division, Redding, California, or approved equal and shall be 3/4" (20mm) minimum thickness, unless otherwise specified.

- a. For Enameled Face Woods: High density particle board may be substituted for plywood panels, unless specified otherwise on drawings.
  - b. For Unexposed Woods: High density particle board may be substituted for plywood panels, unless specified otherwise on drawings.
- 2.1.6 All masonite shall be 1/8" (3 mm) thick tempered, as manufactured by Masonite Corporation, Chicago, Illinois, or an approved equal.
- 2.1.7 All pegboard shall be 1/8" (3 mm) thick tempered as manufactured by Masonite Corporation, Chicago, Illinois, unless otherwise specified.
- 2.1.8 All panelwork materials shall be as indicated on drawings and specifications constructed of 3/4" (20 mm) plywood (or high density particleboard) with finish veneer front side, and veneer of similar thickness, density and characteristics back side, and hardwood edges. Finish veneer and hardwood edges shall be of species indicated on drawings and specifications using the type of veneer cut and type of match between individual veneer pieces as indicated.
- 2.1.9 All Millwork shall be finished as indicated on drawings and specifications. Transparent and Opaque Finishes shall match approved samples submitted according to Section 01300 and Paragraph 1.2 above. All plastic laminate finishes shall be of the quality, color and finish as indicated on the drawings and specifications.

## 2.2 Finishes

- 2.2.1 All millwork shall be finished in accordance with the drawings, specifications and the quality levels indicated in Section 1.3 and as described herein.
- 2.2.2 All finishes shall be in compliance with all Code and Regulatory Agency requirements for the Project and location within in the Project.
- 2.2.3 All finish materials shall be treated with flame-retardant process where required by local code. Should flame-retardant process cause change in color and effect on finish material. Interior Contractor shall notify the Consultant.
- 2.2.4 Prior to finishing woods shall be filled, sanded, primed, and cleaned. When necessary for an even final finish color bleach woods prior to filling and sanding.
- 2.2.5 Transparent finishes on wood shall be full filled, stained to match the color required by the Consultant, and have a water, alcohol, and burn resistant finish, the degree of sheen to match the sample provided by the Consultant.
- 2.2.6 All paint and other finish material shall be pure, unadulterated and best quality from specified manufacturer as indicated on the drawings and specifications.

## 2.3 Hardware and Accessories

- 2.3.1 Where products are not specified in the Contract Documents the Interior Contractor shall recommend hardware to provide the function or condition indicated in the Documents. Hinges, screws, slips, and all other mountings, attachments, and fasteners to be concealed

unless otherwise noted.

- 2.3.2 All Millwork hardware and accessories shall be furnished and installed by Millwork Contractor and shall be as indicated on drawings and specifications.
- 2.3.3 Interior Contractor shall submit samples of each hardware item/type and accessory item/type to Consultant for approval according to Paragraph 1.2 above and Section 01300.
- 2.3.4 All Millwork hardware and accessories shall be installed in accordance with manufacturer's recommendations.
- 2.3.5 All hardware shall be provided with necessary facilities for locking, unless otherwise specified. Locks shall be flush mounted unless noted otherwise. All locks shall be furnished with two (2) keys and all locks shall be master keyed. Unless otherwise specified, doors with die-stamped door pulls shall not require locking devices, unless otherwise specified.

## 2.4 Other Materials

- 2.4.1 Interior Contractor shall be responsible for providing and installing all items and materials as indicated on drawings and specifications comprising all or part of the Millwork shown. Such items and materials shall be fabricated and/or installed according to manufacturer's recommendations and comply with applicable AWI Quality Standards and Industry Standards.
- 2.4.2 Such items and materials may include but not be necessarily limited to the following and shall comply with the requirements indicated unless indicated otherwise on drawings and specs:
  - a. Conduit, Flexible: Shall be fabricated of zinc-coated steel used in continuous runs with approved fittings at connections to ballast or utility boxes.
  - b. Conduit, Rigid: Shall be fabricated of steel, zinc-coated inside and out by sherardizing, hot-dipping or metallic process. Conduit shall be attached to ballast or utility boxes with double lockouts, bushings, or approved fittings.
  - c. Outlet Boxes and Plates: Shall be one piece pressed steel, zinc or cadmium plates, knock-out type and shall be provided with necessary extension and/or plaster rings. Cover plates shall be as specified. Switches and outlets shall match cover plates.
  - d. Receptacles: Shall be 3-wire polarized type Switch-Lock design as manufactured by Harvey-Hubbell, Inc., Bridgeport, Connecticut, or approved equal. Maximum load for duplex receptacle shall be 10 amps. total. Maximum load for single receptacle shall be 20 amps. Receptacle plates and receptacles to have finish as specified by Consultant. Ground fault outlets required in all damper wet locations.
  - e. Junction Boxes: Shall be minimum 4" (100 MM) octagon or square and in no case smaller than size required by local ordinance.

- f . Lights: Shall be U.L. approved. Unless specified otherwise, lamps shall be slim-line type T-6 furnished and installed in reflector as shown on drawings. All slim-line lamps shall be Deluxe warm white, unless otherwise specified. Interior Contractor shall be responsible for providing lighting in Millwork items unless otherwise noted.
- g . Ballasts: Shall be U.L. approved 430 MA for all areas except cocktail lounge area, which shall be 120 MA. Ballast shall be located in an accessible area, or as indicated on drawings and specifications.
- h . Gaskets: For low temperature seal shall be replaceable extruded or molded live rubber of such nature as not to absorb moisture or harden at low temperatures. Gaskets shall be shaped with flat mounting surfaces and sealed to prevent harborage of vermin. Gaskets used in conjunction with magnetic doors shall be as per drawings and as specified.
- i . Glass and related items: Unless specified otherwise in drawings and specifications shall be in accordance with Section 08800 and as follows:
  - 1 . All glass shall bear the label of its manufacturer and shall conform in all respects with the pertinent requirements of Fed. Spec. DD-G-1403 for tempered and heat strengthened glass and DD-G-451 for float and wire glass.
    - a . Float Glass - Type I, Quality Q3.
    - b . Tempered Glass: Provide prime glass of color and type indicated, which has been heat treated to strengthen glass in bending to not less than 4.5 times annealed strength. Where sandblasting, etching, carving, or beveling are required, those processes may be done prior to tempering.
    - c . Mirror Glass - 1/4" (6MM) thick, type I, class 1, Quality q2, conforming to U. S. Federal Specification FS-DD-G-451, free from bubbles, waves, or other defects. Silver coating and protective electrolytic copper coating shall be not less than .0002" thick, complying with CS27. Paint mirror back surface with 2 coats of manufacturer's special mirror backing paint totaling 2.0 mils dry film thickness. Glass to have ground smooth and polished eased square edges, unless specified otherwise in drawings and specifications. All mirrors shall be guaranteed against silver oxidation.
    - d . Refer to Drawings for glass thickness, glass shall be not less than 1/4" (6MM) thick.
  - 2 . Float Glass Cement and/or mirror mastic shall be as recommended by the Glass and/or Mirror manufacturer respectively and shall be compatible with the surfaces contacted.

3. Provide putty, gaskets and glazing sealant as specified and as recommended by the

manufacturer for the required application and condition of installation in each case. Provide only compounds which are known (proven) to be fully compatible with surfaces contacted. Color shall be as specified on drawings and specifications; submit 3, 12" (300 MM) long samples of each color required for each type of glazing sealant exposed to view. Install sample between two strips of material similar to or representative of channel surfaces where sealant will be used, held apart to represent typical joint widths. Samples will be reviewed by Consultant for color and texture only. Compliance with other requirements is the exclusive responsibility of the Interior Contractor. Attachment of mirror shall be invisible where possible. Where visible slips or attachments must be used details for attachment and the slips must be approved by Consultant.

4. Provide only laminated or tempered glass.
5. Interior Contractor to coordinate with Operator and Owner in providing warnings in guestrooms where laminated or tempered glass top tables are in use.

j. **Marble, Granite, Travertine, and Stone: Provide in accordance with Section \_\_\_\_\_, the drawings and specifications and as follows:**

1. Where the term "Marble" is used it shall mean marble, granite, travertine or interior stone.
2. Thickness of marble shall be as indicated on drawings and specifications. Minimum thickness shall be 3/4" (20 MM). Where materials are to be thicker than 3/4" (20 MM), cubic or built-up for 3/4" (20 MM) materials may be used. Where built-up sections are used construction and details must be submitted to and approved by the  
  
Consultant.
3. Interior Contractor shall submit three samples of each marble prior to fabrication in accordance with Section 0130. Samples shall show proposed surface texture, finish, and edge detail and shall be of sufficient size to show full range of color and pattern  
- 12" X 12" (300MM X 300MM) minimum.
4. Interior Contractor shall submit sample of each marble profile specified.
5. Interior Contractor shall submit three (3) samples of each grout to be used.

6. All marble must be treated with penetrating sealer and protective top coat. Marble/sealer shall be burn, water and alcohol resistant. Interior Contractor shall submit Manufacturer's literature for approval by Consultant.
- k. All adhesives, glues, and mastic shall be as recommended for the required application and condition of installation in each case by the manufacturer of the material/item being adhered and meet Premium Grade/Best Quality Industry Standards. Only compounds which are proven to be fully compatible with surfaces contacted shall be used. Conditions which must be accommodated, with approved adhesives, may include but not be limited to the following:
1. Mirror and Glass Setting: Mirror-Mastic as manufactured by 3M Company.
  2. Sealant: Formula EC-152 as manufactured by 3M Company, "butter-test" and shall be non- odorous.
  3. Load Bearing: Weldwood Plastic Resin Glue as manufactured by U. S. Plywood Corporation.
  4. Moisture Areas: Weldwood Plastic Resin Glue  
as manufactured by U. S. Plywood Corporation.
  5. Plastic Laminating: As recommended by Laminating manufacturer.
- l. Insulation shall be as required by the application and condition of installation in each case. Provide material, type, and density for the required insulating as recommended by the insulation manufacturer for the use indicated. Fiberglass may be used for insulation against heat; Rigid Polystyrene Foam may be used for insulation against cold; Approved manufacturers are as follows:
- Manville Owens-  
Corning Dow
- All insulation shall meet all applicable codes, standards, and regulations for the Millwork use indicated.
- m. All resilient covering materials shall be as specified and shall be applied as per manufacturer's recommendations.
  - n. Upholstery material shall be as indicated on the drawings and specifications.
  - o. Wallcovering material shall be as indicated on the drawings and specifications and shall be applied as per manufacturer's recommendations.

## PART 3: EXECUTION

### 3.1 Examination of Conditions

- 3.1.1 The Interior Contractor shall be responsible for examination of the substrate and the conditions under which the work under this section is to be performed. Do not proceed with the work under this section until unsatisfactory conditions have been corrected.

### 3.2 Fabrication

- 3.2.1 All work shall be performed in such manner as to fulfill the intent of the drawings and specifications.
- 3.2.2 All items to be mill fabricated per AWI Premium Grade specifications and according to the sizes and designs indicated on the drawings and specifications, and assembled in single and complete units insofar as the dimensions thereof will permit shipment to and installation at the building. Large pieces requiring sectional construction shall have their several parts accurately fitted and aligned with each other and be provided with ample screws, glue and bolt blocks, tongues, grooves and splines, dowels, mortises and tenons, screws, bolts, or suitable means of concealed fastening, as required to render the work substantial, rigid and permanently secured in proper position to each related section.
- 3.2.3 Where necessary to fit at site provide ample allowance for cutting and fitting. Sufficient additional material shall be allowed to permit accurate scribing to walls, floors and related work; and due allowance made wherever possible for such shrinkage as may develop after installation. All single and sectional units shall be provided with adequate cleating, blocking, crating and other forms of protection as required to preclude damages thereto during shipping and handling.
- 3.2.4 Framing and blocking members shall be assembled with bolted and screwed connections, and shall be secured to the structural backings with expansion screws, or toggle bolts, as required, spaced and installed so as to insure ample strength and rigidity. Rails and stiles shall be mortised and tenoned, work neatly mitered and membered, all butt joints made flush and smooth, and all permanent joints made up with water- resistant glue. All fixtures shall be assembled without face screws or nails, except where it may be necessary to attach trim items. All face screws or nails which are necessary to attach trim items shall be countersunk and plastic wood or wood plugs used to cover heads, and the plug neatly touched up. The heads of all screws used in any assembly shall be countersunk below the surface.
- 3.2.5 On Millwork whose face is to receive a transparent finish, all exposed surfaces of wood and/or plywood behind closed doors (i.e. millwork interior) shall be sanded smooth, given one coat of transparent finish, and two coats of clear polyurethane varnish in the mill before shipping to job site. The transparent finish shall match the face finish unless indicated otherwise on drawings and specifications.
- 3.2.6 On Millwork whose face is to receive an opaque finish, or to be finished with plastic laminate, all exposed surfaces of wood and/or plywood behind closed doors (i.e. millwork interior) shall be sanded smooth and given two coats of semi-gloss paint in the mill before shipping to job site. The color of the paint shall match the opaque face finish or plastic laminate face finish unless indicated otherwise on drawings or specifications.

- 3.2.7 All items where paint is required shall be shop spray finished except where impractical or otherwise specified.
- 3.2.8 Backsides of all Millwork cabinets, counters and shelving concealed by the building shall be given a prime coat of paint, color to closely approximate the value and hue of the face finish.
- 3.2.9 All shelving shall be adjustable unless indicated otherwise on drawings and specifications.
- 3.2.10 Plastic Laminate edges shall be square, self- edged, or post formed as indicated on drawings. Metal trim is not acceptable. Edges shall be neatly beveled; joints shall be minimized in quantity and be made to a smooth hairline and puttied. Appearance of unsightly or excessive joints will be cause for rejection.

### 3.3 Installation

- 3.3.1 Install all Millwork straight, plumb, level and in true alignment except where otherwise indicated. Fit all joints closely and fasten all pieces rigidly in place. Nails shall be finish or casing nails. Countersink nail heads and leave ready for putty. Joints shall be neatly matched and mitered. Fill exposed joints prior to jointing.
  - a. Finished size shall be as indicated on the drawings.
  - b. Surfaces shall be left free from hammer marks, free from warp, twist, open joints or other defects and shall be cleaned, scraped and sanded ready for finishing.
  - c. Lengths of all running trim shall be as long as practical.
  - d. Shim as required using concealed shims.
- 3.3.2 Cut Millwork to fit unless specified to be shop- fabricated or shop-cut to exact size. Where Millwork abuts other finished work, scribe and cut for accurate fit. Before making cutouts, drill pilot holes at corners.
- 3.3.3 Distribute defects allowed in the quality grade specified to the best overall advantage, when installing job assembled Millwork items.
- 3.3.4 Install trim and moldings in single, unjointed lengths for openings and for runs less than maximum length of lumber available. For longer runs, use only one piece less than maximum length available in any straight run. Stagger joints in adjacent members.
- 3.3.5 Attach Millwork securely in place with uniform joints providing for thermal and building movements. Attach to substrates by anchoring and fastening as shown, as required by recognized standards, and as follows:
  - a. Nailing: Blind nail where possible. Use fine finishing nails where exposed. Set exposed nail heads for filling except for exterior wood which is to receive a natural finish (if any).
  - b. Anchoring: Secure millwork to anchors or blocking built-in or directly attached



to substrates.

3.3.6 Where finishes are applied at job site, clean Millwork and fill nail holes in preparation for finishes application. Where Millwork is to receive a transparent finish, use matching wood filler.

3.3.7 For Fire-Retardant Millwork, handle, store and install in accordance with manufacturer's direction and as required to meet the required classification or rating. Provide special fasteners, adhesives and other accessories as tested and listed for the type of fire-retardant work indicated. Re-coat any and all cut surfaces with a heavy brush coating of the same compound used for wood treatment.

3.3.8 Fit Millwork to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper support.

### 3.4 Cleaning and Protection

3.4.1 Cleanshop finished Millwork, touch-up finish as required and remove refinish damaged or soiled areas of finish.

3.4.2 Provide temporary boxing as required and protect installed Millwork from damage by work of other trades until Owner's acceptance of the work. Subcontractor to advise Interior Contractor of procedures and precautions for protection of materials and installed Millwork from damage and of the required temperature/humidity conditions which must be maintained during the remainder of the construction period in areas of Millwork installations.

**END OF SECTION**

**SECTION 07 21 01  
SOUND ATTENUATION BLANKETS**

**PART 1.0 GENERAL**

**1.1 SUMMARY**

- A Section Includes:
  - 1 Glass-fiber blanket as sound attenuation batts (SAB).
  - 2 Mineral-wool blanket as sound attenuation batts (SAB).

**1.2 ACTION SUBMITTALS**

- A Product Data: For each type of product.

**1.3 INFORMATIONAL SUBMITTALS**

- A Product test reports.
- B Research reports.

**PART 2.0 PRODUCTS**

**2.1 GLASS-FIBER SOUND ATTENUATION BLANKET (SAB)**

- A Glass-Fiber Blanket, Unfaced (SAB): ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

**2.2 MINERAL-WOOL SOUND ATTENUATION BLANKETS (SAB)**

- A Mineral-Wool Blanket, Unfaced (SAB): ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics

**2.3 ACCESSORIES**

- A Insulation for Miscellaneous Voids:
  - 1 Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
- B Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.

**PART 3.0 EXECUTION**

**3.1 INSTALLATION, GENERAL**

- A Comply with insulation manufacturer's written instructions applicable to products and applications.
- B Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths.

Apply single layer of insulation units unless multiple layers are otherwise shown or required to provide sound deadening attenuation batts.

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

A Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

- 1 Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
- 2 Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
- 3 Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
- 4 For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically.

B Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

- 1 Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.

**END OF SECTION 07 21 01**

## SECTION 07 92 00 JOINT SEALANTS

### PART-1 GENERAL

#### 1.1 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

##### 1.1.1 Federal Specification (Fed. Spec.)

TT-P-38D Paint, Aluminum, Ready-Mixed & Am 1

##### 1.1.2 American Society for Testing and Materials (ASTM) Publications

C 570-72 Oil- and Resin-Base Caulking Compound (R 1978) for Building Construction

C 834-76 Latex Sealing Compounds

C 920-79 Elastomeric Joint Sealants

#### 1.2 SUBMITTALS

Parsons WRPM approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. **Certificates of Conformance or Compliance:** Submit certificates from the manufacturers attesting that materials meet the specified requirements.
- B. **Manufacturers' Descriptive Data:** Submit complete descriptive data for each type of material. Clearly mark data to indicate the type the Subcontractor intends to provide. Data shall state conformance to specified requirements. Data for sealant and caulking shall include application instructions, shelf life, mixing instructions for multi-component sealants, and recommended cleaning solvents.
- C. **Colors:** Submit one sample of each color for each sealant and caulking type to verify that products match the colors indicated. Where colors are not indicated, submit not less than two (2) different samples of manufacturers' standard colors for selection by the RE.

#### 1.3 SAMPLE JOINTS

Before sealant and caulking work is started, provide a sample of each type of finished joint where directed. The sample shall show the workmanship, bond, and color of sealant or caulking. The workmanship, bond, and color of sealant or caulking work throughout the project shall match the approved sample joints.

#### 1.4 ENVIRONMENTAL CONDITIONS

The ambient temperature shall be within the limits of 40 and 100 degrees F when the sealant and caulking are applied.

#### 1.5 DELIVERY AND STORAGE

Deliver materials to the job site in the manufacturers' external shipping containers, unopened, with brand names, date of manufacture, and material designation clearly marked thereon. Containers of elastomeric sealant shall be labeled as to type, class, grade, and use. Carefully handle and store all materials to prevent inclusion of foreign materials or subjection to sustained temperatures exceeding 100 degrees or less than 40 degrees F.

## **PART-2 PRODUCTS**

### **2.1 MATERIALS**

Products shall conform to the reference documents listed for each use. Color of sealant and caulking shall match adjacent surface color unless specified otherwise. For ASTM C 920 sealants, use a sealant that has been tested on the type(s) of substrate to which it will be applied.

#### **2.1.1 Interior Caulking or Sealant**

[ASTM C 834] [ASTM C 570, Type I] [ASTM C 920, Type S or M, Grade NS, Class 12.5, Use NT]. Color of caulking or sealant shall be white.

#### **2.1.2 Exterior Sealant**

For joints in vertical surfaces, provide ASTM C 920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C 920, Type S or M, Grade P, Class 25, Use T. Color of sealant shall be white.

#### **2.1.3 Sealant**

ASTM C 920, Type S or M, Grade P, Class 25, Use T. Color of sealant shall be white.

#### **2.1.4 Primer for Sealant**

Use a non-staining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.

#### **2.1.5 Primer for Oil- and Resin-Base Caulking**

Use ready-mixed aluminum paint, Fed. Spec. TT-P-38.

#### **2.1.6 Bond Breakers**

Use the type and consistency recommended by the sealant manufacturer for the particular application.

#### **2.1.7 Backstops**

Use glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by the sealant manufacturer. Backstop material shall be compatible with the sealant. Do not use oakum and other types of absorptive materials as backstops.

## **PART-3 EXECUTION**

### **3.1 SURFACE PREPARATION**

Surfaces shall be clean, dry to the touch, and free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. Where adequate grooves have not been provided, clean out grooves to a depth of 1/2 inch and grind to a minimum width of 1/4 inch without damage to the adjoining work. No grinding shall be required on metal surfaces.

#### **3.1.1 Steel Surfaces**

Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finish work, scraping and wire brushing. Remove protective coatings by sandblasting or using a solvent that leaves no residue.

#### **3.1.2 Aluminum or Bronze Surfaces**

Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive just prior to sealant application. Use non-staining solvents recommended by the item manufacturer.

## **3.2 SEALANT PREPARATION**

Do not modify the sealant by addition of liquids, solvents, or powders. Mix multi-component elastomeric sealants in accordance with manufacturer's printed instructions.

## **3.3 APPLICATION**

### **3.3.1 Backstops**

Where joint cavities are constructed deeper than indicated, tightly pack the back or bottom with backstop material to provide a joint of the depth indicated. Install backstops dry and free of tears or holes.

### **3.3.2 Primer**

Just prior to application of the sealant or caulking compound, clean out all loose particles from joints. Apply primer in accordance with compound manufacturer's directions. Do not apply primer to exposed finish surfaces.

### **3.3.3 Bond Breaker**

Provide bond breakers as recommended by the sealant manufacturer for each type of joint and sealant used.

### **3.3.4 Sealant and Caulking Compounds**

Use a compound that is compatible with the material to and against which it is applied. Do not use a compound that has exceeded its shelf life or has become too jelled to be discharged in a continuous flow from the gun. Apply the compound in accordance with the manufacturer's printed instructions. Force the compound into joints with sufficient pressure to fill the joints solidly. Compound shall be uniformly smooth and free of wrinkles.

- A. Interior Sealant and Caulking: Provide sealant or caulking at all exposed joints in the building and at all joints indicated to receive sealant or caulking.
- B. Exterior Sealant: Provide sealant at all joints around the perimeter of openings and at all exposed joints on the building and at all joints indicated to receive sealant.
- C. Floor Joint Sealant: Provide sealant in all control joints and in other floor joints indicated or specified.

## **3.4 PROTECTION AND CLEANING**

### **3.4.1 Protection**

Protect areas adjacent to joints from compound smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

### **3.4.2 Cleaning**

Immediately scrape off fresh compound that has been smeared on masonry and rub clean with a solvent as recommended by the compound manufacturer. Upon completion of compound application, remove all remaining smears and stains resulting there from and leave the work in a clean and neat condition.

**END OF SECTION**

**THIS PAGE INTENTIONALLY LEFT BLANK**

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

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Standard hollow metal doors and frames.

**1.2 SUBMITTALS**

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

**1.3 QUALITY ASSURANCE**

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
  1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
- B. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.
- C. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.



## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Amweld Building Products, LLC.
  2. Benchmark; a division of Therma-Tru Corporation.
  3. Ceco Door Products; an Assa Abloy Group company.
  4. Curries Company; an Assa Abloy Group company.
  5. Deansteel Manufacturing Company, Inc.
  6. Firedoor Corporation.
  7. Fleming Door Products Ltd.; an Assa Abloy Group company.
  8. Habersham Metal Products Company.
  9. Kewanee Corporation (The).
  10. Mesker Door Inc.
  11. Pioneer Industries, Inc.
  12. Security Metal Products Corp.
  13. Steelcraft; an Ingersoll-Rand company.
  14. Windsor Republic Doors.

### 2.2 MATERIALS

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

- I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat.

## 2.3 STANDARD HOLLOW METAL DOORS

- A. General: Comply with ANSI/SDI A250.8.
  1. Design: Flush panel.
  2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
    - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
    - b. Thermal-Rated (Insulated) Doors: R-value of not less than 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W) when tested according to ASTM C 1363.
  3. Vertical Edges for Single-Acting Doors: Beveled edge, 1/8 inch in 2 inches (3 mm in 50 mm).
  4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
  5. Tolerances: SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Comply with ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
  1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).
    - a. Thickness: 1-3/4 inches (44.5 mm).
- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
  1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).
    - a. Thickness: 1-3/4 inches (44.5 mm).
- D. Hardware Reinforcement: ANSI/SDI A250.6.

## 2.4 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
  1. Fabricate frames with mitered or coped corners.
  2. Fabricate frames as face welded unless otherwise indicated.
  3. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.

- C. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
1. Fabricate frames with mitered or coped corners.
  2. Fabricate frames as face welded unless otherwise indicated.
  3. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.
  4. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
  5. Frames for Wood Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
  6. Frames for Borrowed Lights: 0.053-inch- (1.3-mm-) Same as adjacent door frame.
- D. Hardware Reinforcement: ANSI/SDI A250.6.

## 2.5 FRAME ANCHORS

- A. Jamb Anchors:
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
  2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
  3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
  4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
  2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

## 2.6 HOLLOW METAL PANELS

- A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

## 2.7 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, same material as door face sheet.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.

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

## 2.8 LOUVERS

- A. Provide sightproof louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.
  - 1. Fire-Rated Automatic Louvers: Movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated.

## 2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- (6.4-mm-thick by 25.4-mm-) wide steel.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

## 2.10 FABRICATION

- A. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- B. Hollow Metal Doors:
  - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors. Seal joints in top edges of doors against water penetration.
  - 2. Glazed Lites: Factory cut openings in doors.
  - 3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.
- C. Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
  - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
  - 2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
  - 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
  - 5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

6. Jamb Anchors: Provide number and spacing of anchors as follows:
- a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
    - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
    - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
    - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
    - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
  - b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
    - 1) Three anchors per jamb up to 60 inches (1524 mm) high.
    - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
    - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
    - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
    - 5) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal-stud partitions.
  - c. Compression Type: Not less than two anchors in each jamb.
  - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers.
- a. Single-Door Frames: Three door silencers.
  - b. Double-Door Frames: Two door silencers.
- D. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
  2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
  3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
  4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 electrical Sections.
- E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

## 2.11 STEEL FINISHES

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

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Hollow Metal Frames: Comply with ANSI/SDI A250.11.
  1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. At fire-protection-rated openings, install frames according to NFPA 80.
    - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - c. Install frames with removable glazing stops located on secure side of opening.
    - d. Install door silencers in frames before grouting.
    - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    - g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
  2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

- a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
  3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
  4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
  5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
  6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
  9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- B. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
    - a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
  2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
  3. Smoke-Control Doors: Install doors according to [NFPA 105] [UBC Standard 7-2].
- C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

### 3.2 ADJUSTING AND CLEANING

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

**END OF SECTION 08 11 13**



This page intentionally left blank.

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

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Solid-core doors with wood-veneer faces.
2. Shop priming flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

**B. Related Sections:**

1. Division 08 Section "Glazing" for glass view panels in flush wood doors.

**1.2 SUBMITTALS**

**A. Product Data:** For each type of door indicated.[ Include factory-finishing specifications.]

**B. Shop Drawings:** Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire-protection ratings for fire-rated doors.

**C. Samples:** For factory-finished doors.

**1.3 QUALITY ASSURANCE**

**A. Manufacturer Qualifications:** A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

**B. Quality Standard:** In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated".

**C. Forest Certification:** Provide doors made with all wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

- D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing according to NFPA 252 and applicable codes.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Algoma Hardwoods, Inc.
  - 2. Ampco, Inc.
  - 3. Buell Door Company Inc.
  - 4. Chappell Door Co.
  - 5. Eagle Plywood & Door Manufacturing, Inc.
  - 6. Eggers Industries.
  - 7. Graham; an Assa Abloy Group company.
  - 8. Haley Brothers, Inc.
  - 9. Ideal Architectural Doors & Plywood.
  - 10. Ipik Door Company.
  - 11. Lambton Doors.
  - 12. Marlite.
  - 13. Marshfield Door Systems, Inc.
  - 14. Mohawk Flush Doors, Inc.; a Masonite company.
  - 15. Oshkosh Architectural Door Company.
  - 16. Poncraft Door Company.
  - 17. Vancouver Door Company.
  - 18. VT Industries Inc.

### 2.2 DOOR CONSTRUCTION, GENERAL

- A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.
- B. WDMA I.S.1-A Performance Grade:
  - 1. Heavy Duty unless otherwise indicated.
- C. Structural-Composite-Lumber-Core Doors:
  - 1. Structural Composite Lumber: WDMA I.S.10.
    - a. Screw Withdrawal, Face: 700 lbf (3100 N).
- D. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

E. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

## 2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors :

1. Grade: Premium, with Grade AA faces.
2. Species: Match existing or Birch, as directed by Architect.
3. Cut: Quarter sliced.
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Balance match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Core: Particleboard, glued wood stave or structural composite lumber.
8. Construction: Five plies. Stiles and rails are bonded to core, and then entire unit abrasive planed before veneering.
9. Adhesives: Type I per WDMA TM-6.

## 2.4 LIGHT FRAMES

- A. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
- B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; factory primed for paint finish with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated.

## 2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  - 1. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied.
- C. Openings: Cut and trim openings through doors in factory.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
  - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."
  - 3. Louvers: Factory install louvers in prepared openings.

## 2.6 SHOP PRIMING

- A. Doors for Opaque Finish: Shop prime doors with one coat of wood primer specified in Division 09 Section "Exterior Painting" or "Interior Painting" based on location. Seal all four edges, edges of cutouts, and mortises with primer.

## 2.7 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
  - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.
- C. Transparent Finish:
  - 1. Grade: Custom.
  - 2. Finish: AWI catalyzed polyurethane system.
  - 3. Finish: WDMA TR-6 catalyzed polyurethane.
  - 4. Finish: WI System 5 catalyzed polyurethane.
  - 5. Staining: Match Architect's sample to simulate natural Mesquite.
  - 6. Effect: Filled finish.
  - 7. Sheen: Satin.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
  - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
  - 1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
    - a. Comply with NFPA 80 for fire-rated doors.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

**END OF SECTION 081416**

(This page intentionally left blank.)

**SECTION 08 51 13**  
**ALUMINUM WINDOWS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes aluminum windows for exterior locations.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples: For each exposed product and for each color specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Sample warranties.

1.4 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period:
    - a. Window: **10** years from date of Substantial Completion.
    - b. Glazing Units: 10 years from date of Substantial Completion.
    - c. Aluminum Finish 10 years from date of Substantial Completion.



## PART 2 - PRODUCTS

### 2.1 WINDOW PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
1. Window Certification: AAMA certified with label attached to each window.
- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
1. Minimum Performance Class: **As indicated on Drawings.**
  2. Minimum Performance Grade: **As indicated on Drawings**
- C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor **0.32 Btu/sq. ft. x h x deg F (1.83 W/sq. m x K)**
- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of **0.40**.
- E. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of **52**
- F. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change: [**120 deg F (67 deg C) ambient; 180 deg F (100 deg C) material surfaces**]

### 2.2 ALUMINUM WINDOWS

- Jeld-Wen Inc.\* [www.jeld-wen.com](http://www.jeld-wen.com). ...
- Masonite International Inc.\* [www.masonite.com](http://www.masonite.com). ...
- Pella Corp.\* [www.pella.com](http://www.pella.com). ...
- VELUX America Inc. [www.veluxusa.com](http://www.veluxusa.com). ...
- YKK AP Inc.\* [www.ykkap.com](http://www.ykkap.com). ...
- Fortune Brands Home & Security\* [www.fortunebrands.com](http://www.fortunebrands.com). ...
- The Marvin Cos.\* [www.marvin.com](http://www.marvin.com). Warroad, Minnesota. ...
- Ply Gem\* [www.plygem.com](http://www.plygem.com). Cary, North Carolina.

- A. Operating Types: double hung.
- B. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.
- C. Glass: Clear annealed glass, ASTM C 1036, Type 1, Class 1, q3.
1. Kind: Fully tempered [**where indicated on Drawings**] .
- D. Insulating-Glass Units: ASTM E 2190.
1. Glass: ASTM C 1036, Type 1, Class 1, q3.
    - a. Tint: [**Green**] <
    - b. Kind: Fully tempered [**where indicated on Drawings**] >.
  2. Lites].
  3. Filling: Fill space between glass lites with [[**argon**].
  4. Low-E Coating: [**Pyrolytic on second surface**]
  - 5.
- E. Glazing System: [**Manufacturer's standard factory-glazing system that produces weathertight seal**].
- F. Hardware, General: Provide manufacturer's standard corrosion-resistant hardware sized to accommodate sash weight and dimensions.
1. Exposed Hardware Color and Finish: [**As indicated by manufacturer's designations**]
- G. Projected Window Hardware:
1. Gear-Type Rotary Operators: Complying with AAMA 901 when tested according to ASTM E 405, Method A. Provide operators that function without requiring the removal of interior screens or using screen wickets.
    - a. Type and Style: [**Match Architect's sample**]
  2. Hinges: Non-friction type, not less than two per sash.
  3. Lock: [**Manufacturer's standard**]
  4. Limit Devices: Limit clear opening to [**4 inches (100 mm)**] for ventilation; with custodial key release.
- H. Hung Window Hardware:
1. Counterbalancing Mechanism: AAMA 902.
  2. Locks and Latches: Operated from the inside only.
  3. Tilt Latch: Releasing latch allows sash to pivot about horizontal axis.
- I. Horizontal-Sliding Window Hardware:

1. Sill Cap/Track: Designed to comply with performance requirements indicated and to drain to the exterior.
  2. Locks and Latches: Operated from the inside only.
  3. Roller Assemblies: Low-friction design.
- J. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- K. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

## 2.3 ACCESSORIES

- A. Subsills: [**Thermally broken**], extruded-aluminum subsills in configurations indicated on Drawings.
- B. Column Covers: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.
- C. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.
- D. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.
- E. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

## 2.4 INSECT SCREENS

- A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.
1. Type and Location: vertical double hung, sashes.
- B. Aluminum Frames: Complying with SMA 1004 or SMA 1201.
- C. Glass-Fiber Mesh Fabric: [ $<$  mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D 3656/D 3656M.
1. Mesh Color: [**Manufacturer's standard**].

## 2.5 FABRICATION

- A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

- B. Glaze aluminum windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.
- F. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.
- G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

## 2.6 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
- C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
- D. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.
  - 1. Color: **[As selected by Architect from full range of industry colors and color densities]**
- E. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
  - 1. **As selected by Architect from full range of industry colors and color densities]**
- F. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

1. Organic Coating: Thermosetting, modified-acrylic or polyester enamel primer/topcoat system complying with AAMA 2603[, **except with a minimum dry film thickness of 1.5 mils (0.04 mm)**], medium gloss.
  2. Color:[**As selected by Architect from full range of industry colors and color densities**]
- G. High-Performance Organic Finish (Two-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than [**50**] [**70**] percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with [**AAMA 2604**] [**AAMA 2605**] and with coating and resin manufacturers' written instructions.
1. Color and Gloss **As selected by Architect from full range of industry colors and color densities**]
- H. High-Performance Organic Finish (Three-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coatings; Organic Coating: manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
1. Color and Gloss **As selected by Architect from full range of industry colors and color densities**

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

- E. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- F. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- G. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

**END OF SECTION 08 51 13**

**SECTION 08 71 00  
DOOR HARDWARE**

**PART 1 - GENERAL**

**1.1 SUMMARY**

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

**1.2 SUBMITTALS**

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

**1.3 QUALITY ASSURANCE**

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

1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
- B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
- C. Source Limitations: Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
  1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches (1016 mm) or less above the sill.
- E. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system.
- F. Preinstallation Conference: Conduct conference at Project site

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- B. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

#### 1.5 COORDINATION

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

#### 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
  1. Warranty Period: Three years from date of Substantial Completion, except as follows:
    - a. Exit Devices: Two years from date of Substantial Completion.
    - b. Manual Closers: Ten years from date of Substantial Completion.
    - c. Concealed Floor Closers: Five > years from date of Substantial Completion.



## PART 2 - PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

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

### 2.2 HINGES, GENERAL

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

### 2.3 HINGES

- A. Butts and Hinges: BHMA A156.1.
- B. Template Hinge Dimensions: BHMA A156.7.
- C. Manufacturers:
  - 1. Baldwin Hardware Corporation (BH).
  - 2. Bommer Industries, Inc. (BI).
  - 3. Cal-Royal Products, Inc. (CRP).

4. Hager Companies (HAG).
5. Lawrence Brothers, Inc. (LB).
6. McKinney Products Company; an ASSA ABLOY Group company (MCK).
7. PBB, Inc. (PBB).
8. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

## 2.4 SPRING HINGES

- A. Self-Closing Hinges: BHMA A156.17.
- B. Manufacturers:
  1. Baldwin Hardware Corporation (BH).
  2. Bommer Industries, Inc. (BI).
  3. Cal-Royal Products, Inc. (CRP).
  4. Hager Companies (HAG).
  5. Lawrence Brothers, Inc. (LB).
  6. McKinney Products Company; an ASSA ABLOY Group company (MCK).
  7. PBB, Inc. (PBB).
  8. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

## 2.5 PIVOTS AND PIVOT HINGES

- A. Pivots: BHMA A156.4.
- B. Self-Closing Pivot Hinges: BHMA A156.17.
- C. Manufacturers:
  1. Bommer Industries, Inc. (BI).
  2. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
  3. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
  4. Hager Companies (HAG).
  5. IVES Hardware; an Ingersoll-Rand Company (IVS).
  6. McKinney Products Company; an ASSA ABLOY Group company (MCK).
  7. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).
  8. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

## 2.6 LOCKS AND LATCHES, GENERAL

- A. Accessibility Requirements: Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).
- B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- C. Electrified Locking Devices: BHMA A156.25.

- D. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors.
- E. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.
- F. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set.

## 2.7 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:

- 1. Bored Locks: BHMA A156.2.
- 2. Mortise Locks: BHMA A156.13.
- 3. Interconnected Locks: BHMA A156.12.

- B. Bored Locks: BHMA A156.2, Grade 1 unless Grade 2 is indicated; Series 4000.

- 1. Manufacturers:

- a. Arrow USA; an ASSA ABLOY Group company (ARW).
- b. Best Access Systems; Div. of The Stanley Works (BAS).
- c. Cal-Royal Products, Inc. (CRP).
- d. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
- e. Falcon Lock; an Ingersoll-Rand Company (FAL).
- f. Marks USA (MKS).
- g. Medeco Security Locks, Inc.; an ASSA ABLOY Group company (MED).
- h. PDQ Manufacturing (PDQ).
- i. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
- j. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).
- k. Security Door Controls (SDC).
- l. Weiser Lock; a Masco Company (WEI).
- m. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).

- C. Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13, Grade 1 unless Grade 2 is indicated; Series 1000.

- 1. Manufacturers:

- a. Accurate Lock & Hardware Co. (ALH).
- b. Adams Rite Manufacturing Co. (ARM).
- c. Arrow USA; an ASSA ABLOY Group company (ARW).
- d. Best Access Systems; Div. of The Stanley Works (BAS).
- e. Cal-Royal Products, Inc. (CRP).
- f. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
- g. Folger Adam Security Inc.; an ASSA ABLOY Group company (FAS).
- h. Falcon Lock; an Ingersoll-Rand Company (FAL).

- i. Marks USA (MKS).
- j. PDQ Manufacturing (PDQ).
- k. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
- l. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).
- m. Security Door Controls (SDC).
- n. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).

D. Interconnected Locks: BHMA A156.12, Grade 1 unless Grade 2 is indicated; Series 5000.

1. Manufacturers:

- a. Arrow USA; an ASSA ABLOY Group company (ARW).
- b. Cal-Royal Products, Inc. (CRP).
- c. Falcon Lock; an Ingersoll-Rand Company (FAL).
- d. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).

## 2.8 AUXILIARY LOCKS AND LATCHES

A. Auxiliary Locks: BHMA A156.5, Grade 1 unless Grade 2 is indicated.

1. Manufacturers:

- a. ABLOY Security, Inc.; an ASSA ABLOY Group company (ABL).
- b. Accurate Lock & Hardware Co. (ALH).
- c. Adams Rite Manufacturing Co. (ARM).
- d. Arrow USA; an ASSA ABLOY Group company (ARW).
- e. Best Access Systems; Div. of The Stanley Works (BAS).
- f. Cal-Royal Products, Inc. (CRP).
- g. Falcon Lock; an Ingersoll-Rand Company (FAL).
- h. Marks USA (MKS).
- i. Medeco Security Locks, Inc.; an ASSA ABLOY Group company (MED).
- j. PDQ Manufacturing (PDQ).
- k. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
- l. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).
- m. Weiser Lock; a Masco Company (WEI).
- n. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).

## 2.9 EXIT LOCKS AND EXIT ALARMS

A. Exit Locks: BHMA A156.29, Grade 1, surface mounted, battery powered, housed in metal case; with red-and-white lettering reading "EMERGENCY EXIT PUSH TO OPEN--ALARM WILL SOUND."

B. Stand-Alone Exit Alarms: BHMA A156.29, Grade 1, surface mounted on door.

C. Manufacturers:

- 1. Arrow USA; an ASSA ABLOY Group company (ARW).
- 2. Detex Corporation (DTX).

3. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).

## 2.10 DOOR BOLTS

- A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors.
- B. Dustproof Strikes: BHMA A156.16, Grade 1.
- C. Surface Bolts: BHMA A156.16, Grade 1 unless Grade 2 is indicated.
  1. Flush Bolt Heads: Minimum of 1/2-inch- (13-mm-) diameter rods of brass, bronze, or stainless steel with minimum 12-inch- (305-mm-) long rod for doors up to 84 inches (2134 mm) in height. Provide longer rods as necessary for doors exceeding 84 inches (2134 mm).
  2. Manufacturers:
    - a. Burns Manufacturing Incorporated (BM).
    - b. Don-Jo Mfg., Inc. (DJO).
    - c. Door Controls International (DCI).
    - d. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
    - e. Hager Companies (HAG).
    - f. IVES Hardware; an Ingersoll-Rand Company (IVS).
    - g. Stanley Commercial Hardware; Div. of The Stanley Works (STH).
    - h. Trimco (TBM).
- D. Manual Flush Bolts: BHMA A156.16, Grade 1 unless Grade 2 is indicated; designed for mortising into door edge.
  1. Manufacturers:
    - a. Adams Rite Manufacturing Co. (ARM).
    - b. Burns Manufacturing Incorporated (BM).
    - c. Don-Jo Mfg., Inc. (DJO).
    - d. Door Controls International (DCI).
    - e. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
    - f. Hager Companies (HAG).
    - g. Hiawatha, Inc. (HIA).
    - h. IVES Hardware; an Ingersoll-Rand Company (IVS).
    - i. Stanley Commercial Hardware; Div. of The Stanley Works (STH).
    - j. Trimco (TBM).
- E. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1 unless Grade 2 is indicated; designed for mortising into door edge.
  1. Manufacturers:
    - a. Cal-Royal Products, Inc. (CRP).
    - b. Door Controls International (DCI).
    - c. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
    - d. Hager Companies (HAG).
    - e. IVES Hardware; an Ingersoll-Rand Company (IVS).

- f. Trimco (TBM).

## 2.11 EXIT DEVICES

- A. Exit Devices: BHMA A156.3, Grade 1 unless Grade 2 is indicated].
- B. Accessibility Requirements: Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).
- C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- E. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.
- F. Removable Mullions: BHMA A156.3.
- G. Fire-Exit Removable Mullions: Provide removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions shall be used only with exit devices for which they have been tested.
- H. Outside Trim: Lever with cylinder material and finish to match locksets, unless otherwise indicated.
  - 1. Match design for locksets and latchsets, unless otherwise indicated.
- I. Through Bolts: For exit devices and trim on metal doors.
- J. Electronic Exit Bars: Nonlatching electronic releasing device, activated by an adjustable capacitance sensor, with no moving parts; listed and labeled as panic exit hardware. Fabricate bar from extruded aluminum, and provide door and frame transfer device and 16 feet (4.9 m) of cord to route wiring off the door frame.
- K. Manufacturers:
  - 1. Adams Rite Manufacturing Co. (ARM).
  - 2. Arrow USA; an ASSA ABLOY Group company (ARW).
  - 3. Cal-Royal Products, Inc. (CRP).
  - 4. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
  - 5. Detex Corporation (DTX).
  - 6. Door Controls International (DCI).
  - 7. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
  - 8. Dor-O-Matic; an Ingersoll-Rand Company (DOR).
  - 9. Locknetics; an Ingersoll-Rand Company (LSE).

10. Monarch Exit Devices & Door Hardware; an Ingersoll-Rand Company (MON).
11. Precision Hardware, Inc. (PH).
12. Rutherford Controls Int'l. Corp. (RCI).
13. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
14. Von Duprin; an Ingersoll-Rand Company (VD).
15. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).
16. <Insert manufacturer's name.>

## 2.12 LOCK CYLINDERS

- A. Standard Lock Cylinders: BHMA A156.5, Grade 1 unless Grade 2 is indicated.
- B. High-Security Lock Cylinders: BHMA A156.30, Grade 1.
  1. Key Control Level: Category A.
  2. Destructive Test Level: Category A.
  3. Surreptitious Entry Resistance Level: Category A.
- C. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
  1. Number of Pins: Seven.
  2. High-Security Grade: BHMA A156.5, Grade 1A, listed and labeled as complying with pick- and drill-resistant testing requirements in UL 437 (Suffix A).
- D. Permanent Cores: Manufacturer's standard; finish face to match lockset; with interchangeable cores.
- E. Construction Keying: Comply with the following:
  1. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
  2. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
    - a. Furnish permanent cores to Owner for installation.
- F. Manufacturer: Same manufacturer as for locks and latches.
- G. Manufacturers:
  1. ABLOY Security, Inc.; an ASSA ABLOY Group company (ABL).
  2. Arrow USA; an ASSA ABLOY Group company (ARW).
  3. ASSA, Inc.; an ASSA ABLOY Group company (ASA).
  4. Best Access Systems; Div. of The Stanley Works (BAS).
  5. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
  6. Falcon Lock; an Ingersoll-Rand Company (FAL).
  7. Medeco Security Locks, Inc.; an ASSA ABLOY Group company (MED).
  8. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
  9. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).
  10. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).

## 2.13 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference into master system.
  - 1. Existing System: Master key or grand master key locks to Owner's existing system.
  - 2. Existing System: Re-key Owner's existing master key system into new keying system.
- B. Keys: Nickel silver.
  - 1. Quantity: In addition to one extra key blank for each lock, provide three cylinder change keys and five master keys.

## 2.14 OPERATING TRIM

- A. Standard: BHMA A156.6.
- B. Materials: Fabricate from stainless steel, unless otherwise indicated.
- C. Manufacturers:
  - 1. Burns Manufacturing Incorporated (BM).
  - 2. Don-Jo Mfg., Inc. (DJO).
  - 3. Forms + Surfaces (FS).
  - 4. Hager Companies (HAG).
  - 5. Hiawatha, Inc. (HIA).
  - 6. IVES Hardware; an Ingersoll-Rand Company (IVS).
  - 7. Rockwood Manufacturing Company (RM).
  - 8. Trimco (TBM).

## 2.15 ACCESSORIES FOR PAIRS OF DOORS

- A. Carry-Open Bars: Provide carry-open bars for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
  - 1. Material: Polished brass or bronze, with strike plate.

## 2.16 CLOSERS

- A. Accessibility Requirements: Comply with the following maximum opening-force requirements:
  - 1. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
  - 2. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
  - 3. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
- B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.



- C. Hold-Open Closers/Detectors: Coordinate and interface integral smoke detector and closer device with fire alarm system.
- D. Flush Floor Plates: Provide finish cover plates for floor closers unless thresholds are indicated. Match door hardware finish, unless otherwise indicated.
- E. Recessed Floor Plates: Provide recessed floor plates with insert of floor finish material for floor closers unless thresholds are indicated. Provide extended closer spindle to accommodate thickness of floor finish.
- F. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
- G. Surface Closers: BHMA A156.4, Grade 1 unless Grade 2 is indicated. Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.
  - 1. Manufacturers:
    - a. Arrow USA; an ASSA ABLOY Group company (ARW).
    - b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).
    - c. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
    - d. Dor-O-Matic; an Ingersoll-Rand Company (DOR).
    - e. LCN Closers; an Ingersoll-Rand Company (LCN).
    - f. Norton Door Controls; an ASSA ABLOY Group company (NDC).
    - g. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).
    - h. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
    - i. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).
- H. Concealed Closers: BHMA A156.4, Grade 1 unless Grade 2 is indicated.
  - 1. Manufacturers:
    - a. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
    - b. LCN Closers; an Ingersoll-Rand Company (LCN).
    - c. Norton Door Controls; an ASSA ABLOY Group company (NDC).
    - d. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).
    - e. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
- I. Closer Holder Release Devices: BHMA A156.15.
  - 1. Life-Safety Type: On release of hold open, door becomes self-closing. Automatic release is activated by loss of power.
  - 2. Manufacturers:
    - a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (CR).

- b. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
- c. LCN Closers; an Ingersoll-Rand Company (LCN).
- d. Norton Door Controls; an ASSA ABLOY Group company (NDC).
- e. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).
- f. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).

J. Coordinators: BHMA A156.3.

## 2.17 PROTECTIVE TRIM UNITS

- A. Size: 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified in door hardware sets.
- B. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from the following material:
  - 1. Material: 0.050-inch- (1.3-mm-) thick stainless steel.
  - 2. Manufacturers:
    - a. American Floor Products Co., Inc. (AFP).
    - b. Baldwin Hardware Corporation (BH).
    - c. Burns Manufacturing Incorporated (BM).
    - d. Don-Jo Mfg., Inc. (DJO).
    - e. Hager Companies (HAG).
    - f. Hiawatha, Inc. (HIA).
    - g. IPC Door and Wall Protection Systems, Inc.; Div. of InPro Corporation (IPC).
    - h. IVES Hardware; an Ingersoll-Rand Company (IVS).
    - i. Pawling Corporation (PAW).
    - j. Rockwood Manufacturing Company (RM).
    - k. Trimco (TBM).

## 2.18 STOPS AND HOLDERS

- A. Stops and Bumpers: BHMA A156.16, Grade 1 unless Grade 2 is indicated.
  - 1. Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.
- B. Mechanical Door Holders: BHMA A156.16, Grade 1 unless Grade 2 is indicated.
- C. Combination Floor and Wall Stops and Holders: BHMA A156.8, Grade 1 unless Grade 2 is indicated.
- D. Combination Overhead Stops and Holders: BHMA A156.8, Grade 1 unless Grade 2 is indicated.
- E. Electromagnetic Door Holders: BHMA A156.15.

- F. Silencers for Door Frames: BHMA A156.16, Grade 1; neoprene or rubber; fabricated for drilled-in application to frame.
- G. Manufacturers:
  - 1. Architectural Builders Hardware Mfg., Inc. (ABH).
  - 2. Baldwin Hardware Corporation (BH).
  - 3. Burns Manufacturing Incorporated (BM).
  - 4. Cal-Royal Products, Inc. (CRP).
  - 5. Don-Jo Mfg., Inc. (DJO).
  - 6. Door Controls International (DCI).
  - 7. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
  - 8. Dor-O-Matic; an Ingersoll-Rand Company (DOR).
  - 9. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
  - 10. Hager Companies (HAG).
  - 11. HES, Inc.; an ASSA ABLOY Group company (HES).
  - 12. Hiawatha, Inc. (HIA).
  - 13. IVES Hardware; an Ingersoll-Rand Company (IVS).
  - 14. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).
  - 15. Rockwood Manufacturing Company (RM).
  - 16. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
  - 17. Stanley Commercial Hardware; Div. of The Stanley Works (STH).
  - 18. Trimco (TBM).

## 2.19 DOOR GASKETING

- A. Standard: BHMA A156.22.
- B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
  - 1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
  - 2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
  - 3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
- C. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.
  - 1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Gasketing Materials: ASTM D 2000 and AAMA 701/702.

- G. Manufacturers:
1. Hager Companies (HAG).
  2. M-D Building Products, Inc. (MD).
  3. National Guard Products (NGP).
  4. Pemko Manufacturing Co. (PEM).
  5. Reese Enterprises (RE).
  6. Sealeze; a unit of Jason Incorporated (SEL).
  7. Zero International (ZRO).

## 2.20 THRESHOLDS

- A. Standard: BHMA A156.21.
- B. Accessibility Requirements: Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
- C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch (13 mm) high.
- D. Manufacturers:
1. Hager Companies (HAG).
  2. M-D Building Products, Inc. (MD).
  3. National Guard Products (NGP).
  4. Pemko Manufacturing Co. (PEM).
  5. Reese Enterprises (RE).
  6. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).
  7. Sealeze; a unit of Jason Incorporated (SEL).
  8. Zero International (ZRO).

## 2.21 MISCELLANEOUS DOOR HARDWARE

- A. Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosure; filtered and regulated; voltage rating and type matching requirements of door hardware served; and listed and labeled for use with fire alarm systems.
- B. Auxiliary Hardware: BHMA A156.16, Grade 1 unless Grade 2 is indicated.
1. Manufacturers:
    - a. Baldwin Hardware Corporation (BH).
    - b. Cal-Royal Products, Inc. (CRP).
    - c. Don-Jo Mfg., Inc. (DJO).
    - d. Hager Companies (HAG).
    - e. Lawrence Brothers, Inc. (LB).
    - f. Rockwood Manufacturing Company (RM).
    - g. Stanley Commercial Hardware; Div. of The Stanley Works (STH).
    - h. Trimco (TBM).

## 2.22 FABRICATION

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

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Steel Doors and Frames: Comply with DHI A115 Series. Drill and tap doors and frames for surface-applied door hardware according to ANSI A250.6.
- B. Wood Doors: Comply with DHI A115-W Series.
- C. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
  - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- D. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- E. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, [in equipment room. Verify location with Architect.
  - 1. Configuration: Provide one power supply for each door opening.
  - 2. Configuration: Provide the least number of power supplies required to adequately serve doors with electrified door hardware.
- G. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

- H. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
  2. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

### 3.2 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

**END OF SECTION 08 71 00**

**SECTION 09 22 16**  
**NON-STRUCTURAL METAL FRAMING**

**PART 1.0 GENERAL**

**1.1 SUMMARY**

A Section Includes:

- 1 Non-load-bearing steel framing systems for interior gypsum wallboard assemblies.
- 2 Suspension systems for interior ceilings and soffits.

**1.2 ACTION SUBMITTALS**

A Product Data: For each type of product.

- 1 Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."

**PART 2.0 PRODUCTS**

**2.1 FRAMING SYSTEMS**

A Steel Studs and Runners: ASTM C 645.

- 1 Minimum Base-Metal Thickness: 20-ga or as indicated on Drawings.
- 2 Depth: As indicated on Drawings, 2-1/2" and 3-5/8".

**2.2 AUXILIARY MATERIALS**

A General: Provide auxiliary materials that comply with referenced installation standards.

- 1 Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

**PART 3.0 EXECUTION**

**3.1 EXAMINATION**

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

**3.2 PREPARATION**

- A Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

- 1 Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

### **3.3 INSTALLATION, GENERAL**

- A Installation Standard: ASTM C 754.
  - 1 Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B Install supplementary framing, and fire-retardant treated wood blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C Install bracing at terminations in assemblies.
- D Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### **3.4 INSTALLING FRAMED ASSEMBLIES**

- A Install framing system components according to spacing indicated, but not greater than spacing required by referenced installation standards for assembly types.
- B Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C Install studs so flanges within framing system point in same direction, unless directed otherwise in drawing details.
- D Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
  - 1 Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  - 2 Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    - a Install two studs at each jamb unless otherwise indicated.
  - 3 Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  - 4 Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
- E Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry or concrete slab attachment, or powder-driven fasteners spaced 24 inches o.c.

### **3.5 INSTALLING SUSPENSION SYSTEMS**

- A Install suspension system components according to spacing indicated, but not greater than spacing required by referenced installation standards for assembly types.



- B Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C Suspend hangers from building structure as follows:
  - 1 Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
  - 2 Where width of ducts and other construction within ceiling plenum produces hanger spacing that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
  - 3 Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 4 Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 5 Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  - 6 Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

**END OF SECTION 09 22 16**

**SECTION 09 29 00  
GYPSUM BOARD**

**PART 1.0 GENERAL**

**1.1 SUMMARY**

A This Section includes the following:

- 1 Interior gypsum board.

**1.2 SUBMITTALS**

A Product Data: For each type of product indicated.

**1.3 QUALITY ASSURANCE**

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

**1.4 STORAGE AND HANDLING**

A Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

**1.5 PROJECT CONDITIONS**

A Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B Do not install interior products until installation areas are enclosed and conditioned.

C Do not install panels that are wet, moisture damaged, OR mold damaged.

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

**PART 2.0 PRODUCTS**

**2.1 PANELS, GENERAL**

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

**2.2 INTERIOR GYPSUM BOARD**

A General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

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

- a American Gypsum Co.
  - b BPB America Inc.
  - c G-P Gypsum.
  - d Lafarge North America Inc.
  - e National Gypsum Company.
  - f PABCO Gypsum.
  - g Temple.
  - h USG Corporation.
- 2 Regular Type:
- a Thickness: Minimum 5/8 inch, or as required by fire-resistance-rated assembly indicated on drawings.
  - b Long Edges: Tapered
- 3 Type X:
- a Thickness: 5/8 inch.
  - b Long Edges: Tapered.
- 4 Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
- a Thickness: 5/8 inch.
  - b Long Edges: Tapered.
- 5 Purple Paper Type:
- a Thickness: Minimum 5/8 inch, or as required by wet location, water and mold resistance assembly indicated on drawings.
  - b Long Edges: Tapered

## **2.3 TRIM ACCESSORIES**

- A Interior Trim: ASTM C 1047.
- 1 Material: Galvanized or aluminum-coated steel sheet, rolled zinc, or plastic.
  - 2 Shapes:
    - a Cornerbead.
    - b Bullnose bead.

- c LC-Bead: J-shaped; exposed long flange receives joint compound.
- d L-Bead: L-shaped; exposed long flange receives joint compound.
- e U-Bead: J-shaped; exposed short flange does not receive joint compound.
- f Expansion (control) joint.

## 2.4 JOINT TREATMENT MATERIALS

- A General: Comply with ASTM C 475/C 475M.
- B Joint Tape:
  - 1 Interior Gypsum Wallboard: Paper, or as recommended by manufacturer
- C Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1 Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
  - 2 Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
    - a Use setting-type compound for installing paper-faced metal trim accessories.
  - 3 Fill Coat: For second coat, use setting-type, sandable topping compound.
  - 4 Finish Coat: For third coat, use setting-type, sandable topping
  - 5 Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound

## 2.5 AUXILIARY MATERIALS

- A General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  - 1 Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
  - 2 For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D Sound Attenuation Blankets: As specified in Section 07 21 01 "SOUND ATTENUATION BLANKETS".
- E Acoustical Sealant: As specified in Section 07 92 00 "JOINT SEALANTS."

## PART 3.0 EXECUTION

### 3.1 EXAMINATION

- A Examine areas and substrates, with Installer present, and including welded hollow-metal frames and

framing, for compliance with requirements and other conditions affecting performance.

- B Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 APPLYING AND FINISHING PANELS, GENERAL**

- A Comply with ASTM C 840.
- B Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E Form control and expansion joints with space between edges of adjoining gypsum panels.
- F Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1 Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2 Fit gypsum panels around ducts, pipes, and conduits.
- G Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- H Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

### **3.3 APPLYING INTERIOR GYPSUM BOARD**

- A Install interior gypsum board in the following locations:
  - 1 Regular Type: Vertical surfaces, unless otherwise indicated.

- 2 Type X: As indicated on Drawings and Where required for fire-resistance-rated assembly.
- 3 Ceiling Type: Ceiling surfaces.
- 4 Type "Purple Paper": As indicated on Drawings and Where required for wet and moisture resistant assemblies. Smooth, paintable surface that can also be finished with ceramic tile – Water and mold resistant.

**B Single-Layer Application:**

- 1 On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
- 2 On partitions/walls, apply gypsum panels vertically (parallel to framing, unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
  - a Stagger abutting end joints not less than one framing member in alternate courses of panels.
- 3 On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
- 4 Fastening Methods: Apply gypsum panels to supports with steel drill screws.

**C Laminating to Substrate:** Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

### **3.4 INSTALLING TRIM ACCESSORIES**

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

### **3.5 FINISHING GYPSUM BOARD**

- A General:** Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B Prefill open joints, rounded or beveled edges, and damaged surface areas.**

- C Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  - 1 Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2 Level 2: Panels that are substrate for tile and acoustical tile.
  - 3 Level 3: Panels that are to receive a heavy-grade wallcovering as a final finish.
  - 4 Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated
    - a Primer and its application to surfaces are specified in other Division 09 Sections.
  - 5 Level 5: Panels that are to receive gloss, semi-gloss or enamel paints.
    - a Primer and its application to surfaces are specified in other Division 09 Sections.

### **3.6 PROTECTION**

- A Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1 Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2 Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

**END OF SECTION 09 29 00**

**SECTION 09 30 00**  
**TILING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. Ceramic tile.
  2. Crack isolation membrane.
  3. Tile backing panels.
  4. Metal edge strips.

**1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Samples:
1. Each type and composition of tile and for each color and finish required.
  2. Assembled samples, with grouted joints, for each type and composition of tile and for each color and finish required.

**1.3 QUALITY ASSURANCE**

- A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockup of each type of floor and wall tile installation.
  2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

**1.4 EXTRA MATERIALS**

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering and identified with labels describing contents.
1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

**PART 2 - PRODUCTS**

**2.1 TILE PRODUCTS**

- A. ANSI Ceramic Tile Standard: Provide Standard grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
- B. Tile Type CT- Glazed wall tile.



1. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated on Drawings or comparable product by one of the following:
  - a. American Marazzi Tile, Inc.
  - b. American Olean; Division of Dal-Tile International Inc.
  - c. Daltile; Division of Dal-Tile International Inc.
  - d. Florida Tile Industries, Inc.
  - e. United States Ceramic Tile Company.
2. Module Size: As indicated.
3. Thickness: 5/16 inch (8 mm).
4. Face: Pattern of design indicated, with manufacturer's standard edges.
5. Finish: As indicated.
6. Tile Color and Pattern: As indicated..
7. Grout Color: As selected by Architect from manufacturer's full range.
8. Mounting: Factory, back mounted.
9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
  - a. Base: As indicated.
  - b. Wainscot Cap: As indicated.
  - c. External Corners for Thin-Set Mortar Installations: As indicated., same size as adjoining flat tile.
  - d. Internal Corners: As indicated.

## 2.2 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
  1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.
- B. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of [10] [12] per ASTM C 1353 or ASTM C 241 and with honed finish.
  1. Description: Uniform, fine- to medium-grained white stone with minimal veining.
  2. Description: Match Architect's sample.

## 2.3 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Custom Building Products; Wonderboard.
  - b. USG Corporation; DUROCK Cement Board.
2. Thickness: 5/8 inch (15.9 mm) or as indicated.
- B. Fiber-Cement Underlayment: ASTM C 1288.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. CertainTeed Corp.; FiberCement Underlayment or backerBoard as applicable to location.
    - b. James Hardie; Hardiebacker 500.
  2. Thickness: 1/2 inch (12.7 mm).

#### 2.4 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated.
- B. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, SBS-modified-bituminous sheet with woven reinforcement facing; 0.040-inch (1.01-mm) nominal thickness.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. National Applied Construction Products, Inc.; Strataflex.

#### 2.5 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product selected from the following, that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated.
- B. Chlorinated-Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Noble Company (The); Nobleseal CIS.
- C. PVC Sheet: Two layers of PVC sheet heat-fused together and to facings of nonwoven polyester; 0.040-inch (1.01-mm) nominal thickness.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Compositite Corporation; Composeal Gold.

- D. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.203-mm) nominal thickness.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Schluter Systems L.P.; KERDI.
- E. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch (4-mm) nominal thickness.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Schluter Systems L.P.; DITRA.
- F. Fabric-Reinforced, Modified-Bituminous Sheet: Self-adhering, modified-bituminous sheet with fabric reinforcement facing; 0.040-inch (1.01-mm) nominal thickness.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. MAPEI Corporation; Mapelastic SM.
    - b. National Applied Construction Products, Inc.; Strataflex.
- G. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Boiardi Products, a QEP company; Elastiment 344 Reinforced Waterproofing and Anti-Fracture/Crack Suppression Membrane.
    - b. Bonsal American, an Oldcastle company; B 6000 Waterproof Membrane with Glass Fabric.
    - c. Bostik, Inc.; Hydroment Blacktop 90210.
    - d. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
    - e. Laticrete International, Inc.; Laticrete Blue 92 Anti-Fracture Membrane or 9235 Waterproof Membrane.
    - f. MAPEI Corporation; Mapelastic L (PRP M19) or Mapelastic HPG with MAPEI Fiberglass Mesh.
    - g. Mer-Kote Products, Inc.; Hydro-Guard 2000.
    - h. Summitville Tiles, Inc.; S-9000.
- H. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Bostik, Inc.; Durabond D-222 Duraguard Membrane or Hydroment Gold.
    - b. C-Cure; CureLastic 949 or Pro-Red Waterproofing Membrane 963.

- c. Custom Building Products; Redgard Waterproofing and Crack Prevention Membrane, FractureFree Crack Prevention Membrane, or Semco Crack Prevention Membrane.
  - d. Jamo Inc.; Waterproof.
  - e. Mer-Kote Products, Inc.; Fracture-Guard 5000.
  - f. Southern Grouts & Mortars, Inc.; Southcrete 1100 Crack Suppression and Waterproofing.
  - g. TEC, a subsidiary of H. B. Fuller Company; HydraFlex - Waterproofing Crack Isolation Membrane.
- I. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. C-Cure; UltraCure 971.
    - b. MAPEI Corporation; Mapelastic (PRP 315).
    - c. TEC, a subsidiary of H. B. Fuller Company; Triple Flex Waterproofing, Crack Isolation Membrane & Mortar.
- J. Urethane Crack Isolation Membrane and Tile-Setting Adhesive: One-part, liquid-applied urethane[, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Bostik, Inc.; Durabond D-200, Hydroment Ultra-Set, or Hydroment Ultra-Set Advanced.

## 2.6 SETTING MATERIALS

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
- B. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Boiardi Products; a QEP company.
    - b. Bonsal American; an Oldcastle company.
    - c. Bostik, Inc.
    - d. C-Cure.
    - e. Custom Building Products.
    - f. Jamo Inc.
    - g. Laticrete International, Inc.
    - h. MAPEI Corporation.
    - i. Southern Grouts & Mortars, Inc.
    - j. Summitville Tiles, Inc.

- k. TEC; a subsidiary of H. B. Fuller Company.
  - 2. For wall applications, provide nonsagging mortar.
- C. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Boiardi Products; a QEP company.
    - b. Bonsal American; an Oldcastle company.
    - c. Bostik, Inc.
    - d. C-Cure.
    - e. Custom Building Products.
    - f. Jamo Inc.
    - g. Laticrete International, Inc.
    - h. MAPEI Corporation.
    - i. Mer-Kote Products, Inc.
    - j. Southern Grouts & Mortars, Inc.
    - k. Summitville Tiles, Inc.
    - l. TEC; a subsidiary of H. B. Fuller Company.
  - 2. Prepackaged, dry-mortar mix to which only water must be added.
  - 3. Prepackaged, dry-mortar mix combined with liquid-latex additive.
  - 4. For wall applications, provide nonsagging mortar.

## 2.7 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10.
- B. Standard Cement Grout: ANSI A118.6.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Boiardi Products; a QEP company.
    - b. Bonsal American; an Oldcastle company.
    - c. Bostik, Inc.
    - d. C-Cure.
    - e. Custom Building Products.
    - f. Jamo Inc.
    - g. Laticrete International, Inc.
    - h. MAPEI Corporation.
    - i. Southern Grouts & Mortars, Inc.
    - j. Summitville Tiles, Inc.
    - k. TEC; a subsidiary of H. B. Fuller Company.
- C. Polymer-Modified Tile Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Boiardi Products; a QEP company.
  - b. Bonsal American; an Oldcastle company.
  - c. Bostik, Inc.
  - d. C-Cure.
  - e. Custom Building Products.
  - f. Jamo Inc.
  - g. Laticrete International, Inc.
  - h. MAPEI Corporation.
  - i. Southern Grouts & Mortars, Inc.
  - j. Summitville Tiles, Inc.
  - k. TEC; a subsidiary of H. B. Fuller Company.
2. Polymer Type: Dry, redispersible form, prepackaged with other dry ingredients.
3. Polymer Type: Liquid-latex form for addition to prepackaged dry-grout mix.

## 2.8 ELASTOMERIC SEALANTS

- A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."
  1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. DAP Inc.; Titanium Enriched Kitchen and Bath Sealant or 100 percent Silicone Kitchen and Bath Sealant.
    - b. Dow Corning Corporation; Dow Corning 786.
    - c. GE Silicones, a division of GE Specialty Materials; Sanitary 1700.
    - d. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
    - e. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
    - f. Tremco Incorporated; Tremsil 600 White.
- C. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Bostik, Inc.; Chem-Calk 550.
- b. Degussa Building Systems; Sonneborn Sonolastic SL 2.
- c. Pecora Corporation; Dynatrol II-SG or NR-200 Urexpam.
- d. Sika Corporation; Sikaflex-2c SL.
- e. Tremco Incorporated.; THC-900, THC-901, or Vulkem 245.

## 2.9 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Angle or L-shape, white zinc alloy exposed-edge material.
- C. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Bonsal American, an Oldcastle company; Grout Sealer.
    - b. Bostik, Inc.; CeramaSeal Grout & Tile Sealer, Magic Seal, or Silox 8 Siloxane 220.
    - c. C-Cure; Penetrating Sealer 978.
    - d. Custom Building Products; Surfaceguard, Grout and Tile, or Grout Sealer.
    - e. Jamo Inc.; [Matte Finish] [Penetrating] Sealer.
    - f. MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout or 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
    - g. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
    - h. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
    - i. TEC, a subsidiary of H. B. Fuller Company; TA-256 Penetrating Silicone or TA-257 Silicone Grout Sealer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
  - 1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

### 3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- C. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

### 3.3 INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
  - 1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
    - a. Exterior tile floors.
    - b. Tile floors in wet areas.
    - c. Tile floors in laundries.
    - d. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
    - e. Tile floors composed of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Jointing Pattern: Lay tile in pattern indicated or as directed by Architect. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
- E. Joint Widths: Install tile with the joint widths as directed by Architect:
- F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.



- G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
  - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
  - 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- H. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
  - 1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).
- I. Metal Edge Strips: Install [at locations indicated] [where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile] [where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated].
- J. Grout Sealer: Apply grout sealer to[ cementitious] grout joints[ in tile floors] according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- K. Install cementitious backer units and fiber-cement underlayment and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.
- L. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
- M. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

**END OF SECTION 093000**

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

**1.1 SUMMARY**

- A This Section includes acoustical panels and exposed suspension systems for ceilings.
- B Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

**1.2 DEFINITIONS**

- A AC: Articulation Class.
- B CAC: Ceiling Attenuation Class.
- C LR: Light Reflectance coefficient.
- D NRC: Noise Reduction Coefficient.

**1.3 SUBMITTALS**

- A Product Data: For each type of product indicated.
- B Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1 Ceiling suspension system members.
  - 2 Method of attaching hangers to building structure.
  - 3 Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, access panels, and special moldings.
  - 4 Minimum Drawing Scale: 1/8 inch = 1 foot
- C Samples for Initial Selection: For components with factory-applied color finishes.
- D Maintenance Data: For finishes to include in maintenance manuals.

**1.4 QUALITY ASSURANCE**

- A Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
- B Source Limitations:
  - 1 Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
  - 2 Suspension System: Obtain each type through one source from a single manufacturer.
- C Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.
- D Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

- 1 Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.
- E Preinstallation Conference: Conduct conference at Project site to discuss phasing, protection of office furniture & equipment, and dust containment created from ceiling system removal. In addition, discussion of supporting luminaries, detection sensors, and HVAC devices.

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

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

## **1.6 PROJECT CONDITIONS**

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

## **1.7 COORDINATION**

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

## **1.8 EXTRA MATERIALS**

- A Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1 Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed but not less than one (1) unopened boxes for each type and finish.
  - 2 Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.

## **PART 2.0 PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1 Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.

2 Smoke-Developed Index: 50 or less

## **2.2 ACOUSTICAL PANELS, GENERAL**

- A Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance, unless otherwise indicated.
  - 1 Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
- B Acoustical Panel Colors and Patterns: Basis-of-Design is Armstrong "CALLA". Item # 2820, Match appearance characteristics indicated for product type.
  - 1 Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by FAA from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
- C Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

## **2.3 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING**

- A ACT-1: Subject to compliance with requirements, provide the product indicated on Drawings, or approved equal.
- B Modular Size: 24" x 24" x 7/8"
- C Color: White
- D LR: 0.86
- E NRC: 0.85
- F CAC: 35
- G AC: 170
- H Antimicrobial Treatment: Broad spectrum fungicide and bactericide based.

## **2.4 METAL SUSPENSION SYSTEMS, GENERAL**

- A Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- B Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
- C Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with GA state seismic design requirements.
  - 1 Type: Post-installed expansion anchors.

- 2 Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
- D Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1 Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  - 2 Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire but provide not less than 0.106-inch- diameter wire.
- E Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- F Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches O.C. on all cross tees.
- G Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

## 2.5 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

- A Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1 Armstrong World Industries, Inc.
  - 2 BPB USA
  - 3 Chicago Metallic Corporation
  - 4 Ecophon CertainTeed, Inc.
  - 5 USG Interiors, Inc.

## 2.6 METAL EDGE MOLDINGS AND TRIM

- A Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1 Armstrong World Industries, Inc.
  - 2 BPB USA
  - 3 Chicago Metallic Corporation
  - 4 Fry Reglet Corporation
  - 5 Gordon, Inc.
  - 6 USG Interiors, Inc
- B Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
  - 1 Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise

- indicated.
- 2 For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

## **2.7 ACOUSTICAL SEALANT**

- A Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 1 Acoustical Sealant for Exposed and Concealed Joints:
    - a Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
    - b USG Corporation; SHEETROCK Acoustical Sealant.
  - 2 Acoustical Sealant for Concealed Joints:
    - a OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
    - b Pecora Corporation; BA-98.
    - c Tremco, Inc.; Tremco Acoustical Sealant.

## **PART 3.0 EXECUTION**

### **3.1 EXAMINATION**

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

### **3.2 PREPARATION**

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

### **3.3 INSTALLATION**

- A General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B Suspend ceiling hangers from building's structural members and as follows:
  - 1 Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2 Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
  - 3 Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

- 4 Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  - 5 Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  - 6 When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  - 7 Do not attach hangers to steel deck tabs.
  - 8 Do not attach hangers to steel roof deck. Attach hangers to structural members.
  - 9 Space hangers not more than 48 inches O.C. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
  - 10 Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
- 1 Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  - 2 Screw attach moldings to substrate at intervals not more than 16 inches O.C. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
  - 3 Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
- 1 Arrange directionally patterned acoustical panels as follows:
    - a Install panels with pattern running in one direction parallel to short axis of space.
  - 2 For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
  - 3 Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

### 3.4 CLEANING

- A Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish

damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

**END OF SECTION 09 51 13**



**SECTION 09 65 13**  
**RESILIENT BASE AND ACCESSORIES**

**PART 1.0 GENERAL**

**1.1 SUMMARY**

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

**1.2 SUBMITTALS**

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

**1.3 DELIVERY, STORAGE, AND HANDLING**

- A Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

**1.4 PROJECT CONDITIONS**

- A Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
  - 1 48 hours before installation.
  - 2 During installation.
  - 3 48 hours after installation.
- B Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C Install resilient products after other finishing operations, including painting, have been completed.

**1.5 EXTRA MATERIALS**

- A Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1 Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient but not less than one (1) unopened boxes for each type and finish product installed.

**PART 2.0 PRODUCTS**

**2.1 RESILIENT BASE**

- A Resilient Base:
  - 1 Manufacturers: Provide single-source base & trim accessories, subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work

include, but are not limited to the following:

- a Armstrong World Industries, Inc.
  - b Flexco, Inc.
  - c Johnsonite
  - d Roppe Corporation, USA.
- B Resilient Base Standard: ASTM F 1861.
- 1 Material Requirement: Type TS (rubber, vulcanized thermoset).
  - 2 Manufacturing Method: Group I (solid, homogeneous).
  - 3 Style: Cove (base with toe)
- C Minimum Thickness: 0.125 inch
- D Height: 4 inches
- E Height: Provide 6 inches material to be trimmed as required at sloped raised flooring, as indicated in drawings.
- F Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
- G Outside Corners: Preformed; if radiused corner continue base into inside corner.
- H Inside Corners: Cut tight mitered ends.
- I Finish: If not otherwise indicated, to be as selected by COR from manufacturer's full range.
- J Colors and Patterns: Equal to JOHNSONITE - Color as designated in finish schedule.

## 2.2 RESILIENT MOLDING ACCESSORY

- A Resilient Molding Accessory:
- 1 Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a Burke Mercer Flooring Products; Division of Burke Industries, Inc.
    - b Flexco, Inc.
    - c Johnsonite
    - d R.C.A. Rubber Company (The).
    - e Roppe Corporation, USA.
    - f VPI, LLC; Floor Products Division.
- B Description: Carpet edge for glue-down applications, nosing for carpet, nosing for resilient floor covering, Reducer strip for resilient floor covering, Joiner for tile and carpet, or Transition strips.

- C Material: Resilient rubber
- D Profile and Dimensions: As indicated.
- E Colors and Patterns: If not otherwise indicated, to be selected by COR from full range of industry colors.

### **2.3 INSTALLATION MATERIALS**

- A Trowel able Leveling and Patching Compounds: Latex-modified, Portland cement based, or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

## **PART 3.0 EXECUTION**

### **3.1 EXAMINATION**

- A Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.
  - 1 Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2 Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
  - 3 Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
  - 4 Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
- C Fill cracks, holes, and depressions in substrates with trowel able leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D Do not install resilient products until they are same temperature as the space where they are to be installed.
  - 1 Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

### **3.3 RESILIENT BASE INSTALLATION**

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

Preformed Corners: Install preformed corners before installing straight pieces.

### **3.4 RESILIENT ACCESSORY INSTALLATION**

- A Comply with manufacturer's written instructions for installing resilient accessories.
- B Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

### **3.5 CLEANING AND PROTECTION**

- A Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B Perform the following operations immediately after completing resilient product installation:
  - 1 Remove adhesive and other blemishes from exposed surfaces.
- C Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

**END OF SECTION 09 65 13**

**SECTION 09 65 19  
RESILIENT TILE FLOORING**

**PART 1.0 GENERAL**

**1.1 SUMMARY**

A Section Includes:

- 1 Vinyl composition floor tile (VCT).

**1.2 SUBMITTALS**

- A Product Data: For each type of product indicated.
- B Qualification Data: For qualified Installer.
- C Maintenance Data: For each type of floor tile to include in maintenance manuals.

**1.3 QUALITY ASSURANCE**

- A Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation method indicated.
  - 1 Engage an installer who employs workers for this Project trained or certified by manufacturer for installation techniques required.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

**1.5 PROJECT CONDITIONS**

- A Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
  - 1 48 hours before installation.
  - 2 During installation.
  - 3 48 hours after installation.
- B Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C Close spaces to traffic during floor tile installation.
- D Close spaces to traffic for 48 hours after floor tile installation.
- E Install floor tile after other finishing operations, including painting, have been completed.

**1.6 EXTRA MATERIALS**

- A Furnish extra materials that match products installed and packaged with protective covering for storage

and identified with labels describing contents.

- 1 Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed but not less than two (2) unopened boxes of each size, color and type of tile.

## **PART 2.0 PART-2 PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

- 1 Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

### **2.2 VINYL COMPOSITION FLOOR TILE (VCT)**

- A Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- 1 AB ColorPlus, American Biltrite (Canada) Ltd.
- 2 Armstrong World Industries, Inc.
- 3 Congoleum Corporation
- 4 Mannington Mills, Inc.
- 5 Tarkett, Inc.; NAFCO, Azrock
- 6 Vinylasa Tile, Distributed by American Tile Inc.

- B Tile Standard: ASTM F 1066, Class 2, through pattern.

- C Wearing Surface: Smooth

- D Thickness: 0.125 inch

- E Size: 12 by 12 inches.

- F Colors and Patterns: Refer to finish schedule.

### **2.3 INSTALLATION MATERIALS**

- A Trowel able Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

- B Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.

- C Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

## **PART 3.0 EXECUTION**

### **3.1 EXAMINATION**

- A Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

- B Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- C Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B Concrete Substrates: Prepare according to ASTM F 710.
  - 1 Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2 Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
  - 3 Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
  - 4 Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
- C Fill cracks, holes, and depressions in substrates with trowel able leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D Do not install floor tiles until they are same temperature as space where they are to be installed.
  - 1 Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E Sweep and vacuum substrates clean immediately before installation of resilient products.

### **3.3 FLOOR TILE INSTALLATION**

- A Comply with manufacturer's written instructions for installing floor tile.
- B Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
  - 1 Lay tiles square with room axis
- C Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
  - 1 Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).
- D Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

- F Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, non-staining marking device.
- G Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

### **3.4 CLEANING AND PROTECTION**

- A Comply with manufacturer's written instructions for cleaning and protection of floor tile.
- B Perform the following operations immediately after completing floor tile installation:
  - 1 Remove adhesive and other blemishes from exposed surfaces.
  - 2 Sweep and vacuum surfaces thoroughly.
  - 3 Damp-mop surfaces to remove marks and soil.
- C Floor Polish: Apply two coats of liquid floor polish per manufacturer's written instructions.
- D Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- E Cover floor tile until Substantial Completion.

**END OF SECTION 09 65 19**



**SECTION 09 68 13  
TILE CARPETING**

**PART 1.0 GENERAL**

**1.1 SUMMARY**

- A This Section includes modular, carpet tile.

**1.2 SUBMITTALS**

- A Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate.
- B Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
  - 1 Carpet Tile: Full-size Sample.
  - 2 Exposed Edge, Transition, and other Accessory Stripping: 6-inch-long samples.
- C Product Schedule: For carpet tile. Use same designations indicated on Drawings.
- D Qualification Data: For Installer.
- E Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.
- F Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
  - 1 Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
  - 2 Precautions for cleaning materials and methods that could be detrimental to carpet tile.
- G Warranty: Special warranty specified in this Section.

**1.3 QUALITY ASSURANCE**

- A Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A Comply with CRI 104, Section 5, "Storage and Handling."

**1.5 PROJECT CONDITIONS**

- A Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."
- B Environmental Limitations: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

- C Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

## **1.6 WARRANTY**

- A Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
  - 1 Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
  - 2 Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, and runs, loss of tuft bind strength, dimensional stability, excess static discharge, and delamination.
  - 3 Warranty Period: 10 years from date of Substantial Completion.

## **1.7 EXTRA MATERIALS**

- A Furnish extra materials described below, before installation begins, that match installed products and are packaged with protective covering for storage and identified with labels describing contents.
  - 1 Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than three (1) unopened boxes of each type, color and pattern of tile.

## **PART 2.0 PRODUCTS**

### **2.1 CARPET TILE**

- A Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 1 Interface Modular Carpet Tiles
    - a Color: As indicated on Drawings, refer to finish schedule.
    - b Pattern: Match Center Standard or as designate by Resident Engineer.
- B Primary Backing/Back coating: Manufacturer's standard composite materials.
- C Secondary Backing: Manufacturer's standard material.
- D Size: 24 by 24 inches.
- E Antimicrobial Treatment: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174
- F Performance Characteristics: As follows:
  - 1 Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D 7330.
  - 2 Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
  - 3 Dry Breaking Strength: Not less than 100 lbf according to ASTM D 2646.
  - 4 Tuft Bind: Not less than 15 pounds for loop pile and 6 pounds for cut pile per ASTM D 1335.
  - 5 Delamination: Not less than 4 lbf/in. ASTM D 3936.

- 6 Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
- 7 Dimensional Stability: 0.2 percent or less per ISO 2551 (Aachen Test).
- 8 Resistance to Insects: Comply with AATCC 24.
- 9 Noise Reduction Coefficient (NRC): per ASTM C 423
- 10 Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.
- 11 Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) according to AATCC 16, Option E.
- 12 Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC 174.
- 13 Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

## **2.2 INSTALLATION ACCESSORIES**

- A Adhesives: Water-resistant, mildew-resistant, non-staining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

## **PART 3.0 EXECUTION**

### **3.1 EXAMINATION**

- A Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

### **3.2 PREPARATION**

- A General: Comply with Site Conditions; Floor Preparation of prefinished metal raised access floor system, and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

### **3.3 INSTALLATION**

- A General: Comply with Carpet Modules standard installations and with carpet tile manufacturer's written installation instructions.
- B Installation Method: As recommended in writing by carpet tile manufacturer.
- C Maintain dye lot integrity. Do not mix dye lots in same area.
- D Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, and thresholds. Bind or seal cut edges as recommended by carpet tile manufacturer.
- E Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges,

alcoves, and similar openings.

- F Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, non-staining marking device.
- G Install pattern parallel to walls and borders.

### **3.4 CLEANING AND PROTECTION**

- A Perform the following operations immediately after installing carpet tile:
  - 1 Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
  - 2 Remove yarns that protrude from carpet tile surface.
  - 3 Vacuum carpet tile using commercial machine with face-beater element.
- B Protect installed carpet tile to comply with manufacturer's Protection of Indoor Installations.
- C Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

**END OF SECTION 09 68 13**

**SECTION 10 14 00  
SIGNAGE**

**PART 1 - GENERAL**

- 1.01 Division 1 and the General Conditions apply to all work of this Section.
- 1.02 Description:
- A. Work Included: Furnish all labor, materials, equipment and services necessary to complete the applicable work within this Section of the Specifications as shown on the drawings and/or specified herein, Owner will dictate exact placement of signage which may or may not be indicated on drawings.
  - B. Chemical Storage signs (haz-mat)

**PART 2 - PRODUCTS**

- 2.01 Signage:
- A. Stock signs to denote H.C. parking and path of travel as well as accessibility, loading & fire lanes etc.
  - B. Sign material to be scratch resistant, non-static, fire retardant, washable non-glare surface. Impervious to most acids, alkaline's, alcohol, solvent, abrasives and boiling water. Nema rated self-extinguishing.
  - C. Occupancy & misc signs.
  - D. MSDS Station – Wall mounted station - #1F-17463 by Lab Safety Supply 800 356 0783
- 2.02 Submittals:
- A. Contractor shall submit material sample and full size mock-up of copy to Architect for review in compliance with Section 01300. Do not order signs before review.

**PART 3 - EXECUTION**

- 3.01 Inspection and Preparation:
- A. Contractor shall be responsible for inspection of site, approval of mounting conditions and field measurements for this work.
- 3.02 Installation:
- A. Shall comply with all manufacturer's recommendations.
  - B. All signs shall be installed positively, securely and permanently.
- 3.03 Cleaning:
- A. Clean finished installation of dirt and finger marks, leave work area clean and free of debris.

**END OF SECTION 10 14 00**

## SECTION 10 28 00 TOILET ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Public-use washroom accessories.
  - 2. Under lavatory guards.
  - 3. Custodial accessories.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: Full size, for each exposed product and for each finish specified.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

#### 1.5 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 15 years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

#### 2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Toilet Tissue (Roll) Dispenser:
  - 1. Bobrick; GAMCO, Bradley, American Specialties, AJW, Tubular spec.
  - 2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
  - 3. Mounting: Surface mounted.  
Operation: Non-control delivery with standard spindle
  - 4. Capacity: Designed for 5-inch (127-mm) diameter tissue rolls.
  - 5. Material and Finish: Stainless steel, No. 4 finish (satin).
- B. Combination Towel (Folded) Dispenser/Waste Receptacle:
  - 1. Bobrick; GAMCO, Bradley, American Specialties, AJW, Tubular spec.
  - 2. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
  - 3. Mounting: Semi-recessed.

- a. Designed for nominal 4-inch (100-mm) wall depth.
  - 4. Minimum Towel-Dispenser Capacity: 600 C-fold multifold paper towels.
  - 5. Minimum Waste-Receptacle Capacity: 4 gal. (15 L).
  - 6. Material and Finish: Stainless steel, No. 4 finish (satin).
  - 7. Liner: Reusable, vinyl waste-receptacle liner.
  - 8. Lockset: Tumbler type for towel-dispenser compartment and waste receptacle.
- C. Liquid-Soap Dispenser:
- 1. Bobrick; GAMCO, Bradley, American Specialties, AJW, Tubular spec.
  - 2. Description: Designed for dispensing antibacterial soap in liquid or lotion form.
  - 3. Mounting: Vertically oriented, surface mounted.
  - 4. Capacity: 40 fl. oz.
  - 5. Materials: Stainless steel, No. 4 finish (satin).
  - 6. Lockset: Tumbler type.
  - 7. Refill Indicator: Window type.
- D. Grab Bar:
- 1. Bobrick; GAMCO, Bradley, American Specialties, AJW, Tubular spec.
  - 2. Mounting: Flanges with concealed fasteners.
  - 3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
    - a. Finish: Smooth, No. 4 finish (satin).
  - 4. Outside Diameter: 1-1/4 inches (32 mm).
  - 5. Configuration and Length: As indicated on Drawings.
- E. Sanitary-Napkin Disposal Unit:
- 1. Bobrick; GAMCO, Bradley, American Specialties, AJW, Tubular spec.
  - 2. Mounting: Surface mounted.
  - 3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
  - 4. Receptacle: Removable.
  - 5. Material and Finish: Stainless steel, No. 4 finish (satin).
- F. Seat-Cover Dispenser:
- 1. Bobrick; GAMCO, Bradley, American Specialties, AJW, Tubular spec.
  - 2. Mounting: Surface mounted.
  - 3. Minimum Capacity: 250 seat covers.
  - 4. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
  - 5. Lockset: Tumbler type.
- G. Mirror Unit:
- 1. Bobrick; GAMCO, Bradley, American Specialties, AJW, Tubular spec.
  - 2. Frame: Stainless-steel channel.
    - a. Corners: Manufacturer's standard.
  - 3. Integral Shelf: 5 inches (127 mm) deep.
  - 4. Hangers: Produce rigid, tamper and theft-resistant installation, using method indicated below.
    - a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
    - b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

5. Size: As indicated on Drawings.

H. Coat Hook:

1. Bobrick; GAMCO, Bradley, American Specialties, AJW, Tubular spec.
2. Description: Single prong unit.
3. Material and Finish: Stainless steel, No. 4 finish (satin).

2.3 UNDERLAVATORY GUARDS

A. Under lavatory Guard:

1. Bobrick; GAMCO, Bradley, American Specialties, AJW, Tubular spec.
2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.4 CUSTODIAL ACCESSORIES

A. Utility Shelf:

1. Bobrick; GAMCO, Bradley, American Specialties, AJW, Tubular spec.
2. Description: With exposed edges turned down not less than 1/2 inch (13 mm) and supported by two triangular brackets welded to shelf underside.
3. Size: 16 inches (406 mm) long by 6 inches (152 mm) deep.
4. Material and Finish: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel, No. 4 finish (satin).

B. Mop and Broom Holder:

1. Bobrick; GAMCO, Bradley, American Specialties, AJW, Tubular spec.
2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Length: 36 inches (914 mm).
4. Hooks: Four.
5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, No. 4 finish (satin).
  - a. Shelf: Not less than nominal 0.05-inch (1.3-mm) thick stainless steel.
  - b. Rod: Approximately 1/4-inch (6-mm) diameter stainless steel.

2.5 FABRICATION

- A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.



- B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

**END OF SECTION 10 28 00**

**SECTION 10 44 16  
FIRE EXTINGUISHERS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

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

**1.2 ACTION SUBMITTALS**

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

**1.3 INFORMATIONAL SUBMITTALS**

- A. Warranty: Sample of special warranty.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

**1.5 COORDINATION**

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

**1.6 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: Six years from date of Substantial Completion.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

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

**2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS**

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

- Pyro chem
- Kidde
- Guardian
- JL industries

1. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type: UL-rated 2-A:10-B:C, 5-lb (2.3-kg) nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

### 2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
  - Pyro chem
  - Kidde
  - Guardian
  - JL industries
- 1.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
  1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
    - a. Orientation: Vertical.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Examine fire extinguishers for proper charging and tagging.
  1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
  1. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

**END OF SECTION 10 44 16**

**SECTION 13 34 19**  
**METAL BUILDING SYSTEMS**

**PART-1 GENERAL**

**1.1 SCOPE**

This Section provides for the construction of a pre-engineered, prefabricated metal building, as referenced herein and as indicated on the Subcontract Drawings.

**1.2 REFERENCED SPECIFICATIONS AND STANDARDS**

The latest editions in effect of the following specifications and standards form a part of this Section and are applicable to the extent specified herein.

**1.2.1 American Institute of Steel Construction (AISC) Publication**

AISC S 326 Specification for the Design, Fabrication and Erection of Structural Steel for Buildings

(Copies of AISI publications may be obtained from the American Institute of Steel Construction, 101 Parks Avenue, New York, NY 10017.)

**1.2.2 American Iron and Steel Institute (AISI) Publication**

Specification for the Design of Light Gauge Cold-Formed Steel Structural Members

(Copies of AISI publications may be obtained from the American Iron and Steel Institute, 1000 16th Street, NW, Washington, DC 20036.)

**1.2.3 American Society for Testing and Materials (ASTM)**

ASTM A 123 Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strips

ASTM A 153 Zinc (Hot-Dip) on Iron and Steel Hardware

ASTM A 446 Specification for Steel Sheets Zinc Coated (Galvanized) by the Hot-Dip Process, Structural Physical Quality

ASTM E 84 Surface Burning Characteristics of Building Materials

(Copies of ASTM standards may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

**1.2.4 American Welding Society (AWS) Standard:**

B3.0 Welding Procedure and Performance Qualification

D1.1 Structural Welding Code - Steel

D1.2 Structural Welding Code - Aluminum

(Copies of AWS publication may be obtained from the American Welding Society, Inc., 2501 NW 7th Street, Miami, Florida 33125.)

### **1.2.5 Door and Hardware Institute Publication (DHI)**

US Standard Finishes for Hardware

(Copies of DHI publications may be obtained from the Door and Hardware Institute, 1815 North Fort Myer Drive, Suite 412, Arlington, Virginia 22209.)

### **1.2.6 Federal Specification**

FF-H-106 Hardware, Builders; Locks and Door Trim

FF-H-111 Hardware, Builders; Shelf and Miscellaneous

FF-H-116 Hardware, Builders; Hinges

(Copies of Federal specifications and standards may be obtained from General Services Administration Offices in Atlanta, GA)

### **1.3.7 Metal Building Manufacturers Association (MBMA) Publication**

Recommended Design Practices Manual

(Copies of MBMA publications may be obtained from the Metal Building Manufacturer Association, 1230 Keith Building, Cleveland, Ohio 44115.)

### **1.2.7 National Fire Protection Association (NFPA) Publication**

No.70 National Electrical Code

(Copies of the National Electrical Code may be obtained from the National Fire Protection Association, 60 Battery Street, Boston, Massachusetts 02110.)

## **1.3 SUBMITTALS**

Parsons WRPM and RE approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Detailed Engineering Design Calculations, Data and Stress Diagrams of all structural and load-bearing components.
- B. Shop Drawings and Erection Instructions of the pre-fabricated building, including the following items and all other details and diagrams necessary to augment erection instructions; structural framework and connections, roofing and siding, fastening system; door air conditioning, conduit, and other openings; flashing, sealed joints, and louvers.
- C. Manufacturer's Catalog Data or other descriptive data of miscellaneous accessories, fasteners, joint sealing material; thermal insulation, including printed installation instructions and details; and factory color protective coatings. Color shall be as indicated on the drawings.
- D. Manufacturer's Catalogs, Shop Drawings, and Installation Instructions for all doors and hardware, describing door and frame types, sizes, gauge of metal, wall thickness where doors will be installed, and other pertinent data.
- E. Test Reports of all tests required by referenced publications applicable to the particular item or material furnished for use, and including permeance rating of insulation facing as specified in paragraph "Permeance Rating; and flame spread rating of insulation as specified in paragraph "Flame Spread Rating."

- F. Guarantee: Copies of the manufacturer's sample 20-year guarantee of factory color protective coating for wall panels and durability of roofing panels.

## **PART-2 PRODUCTS**

### **2.1 BUILDING DESIGN REQUIREMENTS**

#### **2.1.1 Structural**

All structural steel sections and welded plate members shall be designed in accordance with ANSI/AISC 360 "Specifications for Structural Steel Buildings" or the CAN/CSA S16 "Limit States Design of Steel Structures.

#### **2.1.2 Wall Panels**

The wall panels shall be factory-fabricated units consisting of a galvanized steel sheet on the exterior with insulating material between it and the internal metal wall panel. Insulation type shall be as recommended by the building manufacturer and shall meet the insulating requirements shown on the applicable drawings. Wall panels shall be one piece from base to building eaves. The interior panels shall be pre-finished with a factory applied baked-on white finish. The exterior wall panel finish shall be applied in two coats and shall be guaranteed by the manufacturer to endure and resist environmental conditions for 20 years without repainting.

#### **2.1.3 Roof System**

The roof system shall be one of the following:

- A. Self-contained, insulated, factory fabricated units similar to the wall panels.
- B. Galvanized steel roof panel with insulation and ceiling panels.

Insulation type shall be as recommended by the building manufacturer and shall meet the insulating requirements shown on the applicable drawings. In either system, the exposed interior surface shall have a finished appearance that is compatible with the interior wall surface. The building ceiling interior panels shall have 1/8-inch acoustical perforations on 3/8-inch centers. All interior metal panel surfaces shall be pre-finished with a factory baked-on white finish. All exterior roof panels shall be hot dipped with an aluminum/zinc alloy. For type (b) roof systems, ceilings shall be rigid insulation boards with vapor barrier facing on both sides, rigid ceiling panels covered with batt type insulation, or a system of equal durability. The eaves of the building shall have an integral gutter system complete with matching downspouts and hardware.

#### **2.1.4 Heating Transmission**

The maximum heat transmission coefficient value throughout the roof, walls, and doors of the building shall be 0.05 BTU/hr./sq. ft./degree F. Calculations of the actual heat transmission coefficient shall be submitted for approval to the Contracting Officer.

#### **2.1.5 Roof Slopes**

The maximum slope of any portion of the roof shall be 4-inches in 12-inches. The minimum acceptable slope shall be 2-inches in 12 inches.

#### **2.1.6 Anchor Bolts**

Anchor bolts shall be in accordance with the building manufacturer's recommendations.

### 2.1.7 Foundation

It shall be the responsibility of the Subcontractor to field adapt the typical foundation shown on the drawings so that it shall comply with the building manufacturer's design. The Subcontractor shall apply a plastic sealer on the foundation floor before installation of the building and before concrete sets.

### 2.1.8 Openings

All openings for doors, electrical and mechanical equipments shall be provided in the wall panels sized to fit the frames without any requirement for field cutting. Framing kits and structural supports shall be provided for all openings for air conditioners and other mechanical equipments. These equipments shall be securely anchored to the wall to resist all loading conditions to include static and dynamic loads. The openings for these items will be field cut by the erection Subcontractor. Openings for power and control line conduits shall be provided by the erection Subcontractor.

#### 2.1.8.1 Door frames

Door frames shall be suitable for the building wall thickness and door thickness, providing a flush installation with surface-mounted trim on both the interior and exterior.

### 2.1.9 Fire Resistance

Ceiling panels shall produce a flame spread rating of not more than 25 when tested in accordance with ASTM E 84.

## 2.2 MATERIALS

### 2.2.1 Galvanizing

All steel components and parts (including hardware) of the structural system shall be hot-dipped galvanized after fabrication in accordance with ASTM A 123 for structural steel and A 153 for hardware.

### 2.2.2 Steel for Doors

Door steel shall be prime grade, cold rolled sheet steel, properly annealed and process leveled and having smooth, clean surface, in accordance with ASTM A 446.

#### 2.2.2.1 Thickness

Minimum thickness of sheet steel shall be as follows for the work listed:

1) Frames	16 ga. (0.060")
2) Flush type door face panels	18 ga. (0.048")
3) Other hollow metal work not specified otherwise or indicated	18 ga. (0.048")

#### 2.2.2.2 Primer Paint

Primer paint shall be manufacturer's standard rust inhibiting type with a thickness of 5 microns.

## 2.3 WEATHER-STRIPPING

- A. Metal Head and Jamb Units: PEMKO Mfg. Company #312CR, or approved equal.
- B. Metal Door Bottom: PEMKO Mfg. Company #315CN, or approved equal.

## **2.4 THRESHOLD**

PEMKO Mfg. Company #171A, or approved equal.

## **2.5 HARDWARE**

### **2.5.1 Hinge**

ANSI A8133, 1-1/2 pair (3 hinges) per door; Finish 626 Satin Chrome non-rising pins.

### **2.5.2 Lockset**

ANSI A156.2 Series 4000, Grade 2, F81, 1 each door; the lock shall be provided with a seven-pin removable and interchangeable core manufactured by Best Universal Lock Company, Inc., Indianapolis, Indiana. The lock shall be provided with a construction core to be replaced by the Government with a special FAA core. Finish: US Standard Finish US26D. Subcontractor shall provide and install locksets, construction cores, all construction keys (2 min.), and all core keys (2 min.) at end of job. CET shall be given one construction key when construction core is installed.

### **2.5.3 Door Stop**

Glynn Johnson #W27, Finish US26D.

### **2.5.4 Door Bolts**

Tamper resistant surface bolts shall be installed on the top and bottom of all non operating leaf units.

## **2.6 FABRICATION**

### **2.6.1 Building**

The structural frame of the building, wall panels, roof panels, door frames, and doors, shall be factory fabricated. All components and parts shall be clearly marked for identification during erection of the building.

### **2.6.2 2.3.2 Metal Doors**

Doors shall be flush type, 1-3/4 inches thick and shall consist of two face sheets with the edges continuously welded to reinforcement plates or channels. Tops and bottoms of doors shall have continuous formed channels not less than 0.060 inch (16 ga.) thick, welded to the face plates. The web of the top and bottom channels shall be flush with the edge of the door. Reinforcement shall stiffen the sheet metal and shall prevent sagging, warp, and twist. Doors and frames shall be mortised and reinforced for hardware. Cutting, reinforcing, drilling, and tapping of doors and frames shall be done at the factory.

## **PART-3 EXECUTION**

### **3.1 GENERAL**

Concrete foundations and floor slabs shall be level and true, and shall be inspected and approved before the structural steel work is started. Anchor bolts shall be installed while the concrete work is in progress, unless building manufacturer requires otherwise. Templates or other gauging devices shall be used to assure accurate spacing of the anchor bolts. Defects or errors in the fabrication of building components shall be corrected in an approved manner. Defects or errors in fabrication of components, which cannot be corrected in an approved manner shall be replaced by non-defective members at no additional cost to the Government. All field connections shall be bolted, unless indicated or specified otherwise. Rigid frames shall be plumbed in



both directions, guyed and stayed, and all framing elements shall be accurately spaced to assure the proper fitting of prefabricated wall and roof coverings.

### **3.2 SHOP DRAWINGS AND ERECTION INSTRUCTIONS**

Install the prefabricated building and all accessories in accordance with the manufacturer's shop drawings and erection instructions. Any deviation shall be approved by Parsons through the submittal process.

### **3.3 RIGID FRAME AND COLUMN BASES**

Set accurately, using a non-shrinking grouting mortar to obtain uniform bearing on the concrete and still maintain the established floor line elevation. Anchors and anchor bolts for securing rigid frames to foundations shall be hot-dipped galvanized, set accurately with templates, and of proper size to resist adequately all applicable design loads at the base. Grouting mortar shall be a mixture of one part of blended Portland cement, to two parts of well-graded fine aggregate, and enough water to provide a maximum water cement ratio of 0.50. The blended Portland cement shall be a mixture of cement with 1/4-ounce of aluminum powder to each sack of cement. Surfaces to receive the mortar shall be clean and moistened thoroughly immediately before placement of mortar. Exposed surfaces of mortar shall be water cured with wet burlap for seven (7) days.

### **3.4 WALL CONSTRUCTION**

All sheets or panels shall be applied with the corrugations, ribs, or other configurations in a vertical position. Sheets or panels shall be supplied in the longest obtainable lengths, full wall heights from base to eaves with no horizontal joints except at the junctions of door frames, window frames, louver panels, and similar locations. All side and end laps shall be sealed with the joint sealing material. All walls shall be flashed and/or sealed at the base, at the top, around windows, doors, framed louvers, conduit penetrations, and all other similar openings. The placement of closure strips, flashing and sealing materials shall be accomplished in an approved manner which will assure complete weather tightness. Flashing will not be required where approved "self-flashing" sheets or panels are used. Minimum end laps for all types of sheets or panels shall be 2-1/2 inches. Minimum side laps for all types of sheets or panels shall be one corrugation or one configuration. All side and end laps shall be sealed as specified below for roofing, except that only one bead of plastic cement will be required.

### **3.5 ROOF CONSTRUCTION**

Roof slope shall be as indicated. All roofing sheets or panels shall be applied with the corrugations, ribs, or other configurations parallel to the slope of the roof. The roofing sheets or panels shall be supplied in the longest lengths obtainable with end laps occurring only at structural members, full lengths from ridge (or ridge panel) to eaves with no transverse joints except at the junction of ventilators, curbs, and similar openings. All side laps shall be laid away from the prevailing wind, and all side and end laps shall be sealed with the joint sealing material. The roof shall be flashed and sealed at the ridge, at eaves and rakes, at projections through the roof, and elsewhere as necessary. The placement of closure strips, flashing, and sealing material shall be accomplished in an approved manner which will assure complete weather tightness. All contact surfaces between roofing sheets at end and side laps shall be sealed with plastic cement, squeezed from a pressure gun and forming two beads, each not less than 1/4 inch thick, measured from top of bead to surface.

### **3.6 INSULATION**

Insulation shall be installed in strict accordance with the building manufacturer's printed instructions and details, except as specifically specified otherwise herein. Roof insulation shall be installed over purlins before

roofing sheets or panels are applied. Facing shall be exposed on the interior. The completed installation shall be neat in appearance without sags and buckles. Repair any tears in vinyl facing with tape before final inspection.

### **3.7 INSTALLATION OF DOORS AND FINISH HARDWARE**

Install doors and hardware in accordance with manufacturer's instructions. Frames must be square and plumb so all mechanisms will function properly. Adjust doors and hardware for proper operation.

### **3.8 PAINTING**

Painting shall be done in accordance with Section 09 91 00 except as specifically specified otherwise herein. All rust and mars in the shop applied prime coating shall be cleaned and re-primed prior to any additional field painting. Prefabricated building has a factory-applied finish and will not need painting except for touch-up painting of damaged areas.

### **3.9 DISSIMILAR MATERIALS**

Where aluminum surfaces come in contact with ferrous metal or other incompatible metals, the aluminum surfaces shall be kept from direct contact by one of the following methods:

- A. Approved nonabsorptive gasket.
- B. Approved caulking placed between the aluminum and the incompatible metal.
- C. Painting the incompatible metal with a coating of heavy-bodied bituminous paint.

### **3.10 DELIVERY AND STORAGE**

The delivery and storage provisions of Materials and Equipment apply to this Section. Prefabricated components, sheets, panels, and other manufactured items shall be delivered stored and handled in such a manner that they will not be damaged or deformed. Materials stored on the site before erection shall be stacked on platforms or pallets and covered with tarpaulins or other suitable weathertight covering. The sheets or panels shall not be stored in contact with materials which might cause staining.

### **3.11 QUALITY CONTROL**

#### **3.11.1 Test and Test Reports**

The testing requirements stated herein or incorporated in referenced documents may be waived, provided that certified copies of reports of tests from approved laboratories performed on previously manufactured materials are submitted and approved. Test reports shall be accompanied by notarized certificates from the manufacturer certifying that the previously tested material is of the same type, quality manufacture and make as that supplied for this project.

**END OF SECTION**

**THIS PAGE INTENTIONALLY LEFT BLANK**

**SECTION 22 05 00**  
**COMMON WORK RESULTS FOR PLUMBING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Supports and anchorages.

**1.2 DEFINITIONS**

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
1. ABS: Acrylonitrile-butadiene-styrene plastic.
  2. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  2. NBR: Acrylonitrile-butadiene rubber.

### 1.3 SUBMITTALS

- A. Product Data: For the following:
  - 1. Transition fittings.
  - 2. Dielectric fittings.
  - 3. Plumbing piping and fittings.
  - 4. Escutcheons.
- B. Welding certificates, if applicable.

### 1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

### 1.6 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

### 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### 2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. Solvent Cements for Joining Plastic Piping:
  - 1. ABS Piping: ASTM D 2235.
  - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
  - 3. PVC to ABS Piping Transition: ASTM D 3138.

### 2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
  - 1. Known Acceptable Source:
    - a. Cascade Waterworks Mfg. Co.
    - b. Dresser Industries, Inc.; DMD Div.
    - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
    - d. JCM Industries.
    - e. Smith-Blair, Inc.
    - f. Viking Johnson.
  - 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
  - 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.

4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
  1. Known Acceptable Source:
    - a. Eslon Thermoplastics.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
  1. Known Acceptable Source:
    - a. Thompson Plastics, Inc.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
  1. Known Acceptable Source:
    - a. NIBCO INC.
    - b. NIBCO, Inc.; Chemtrol Div.
- E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
  1. Known Acceptable Source:
    - a. Cascade Waterworks Mfg. Co.
    - b. Fernco, Inc.
    - c. Mission Rubber Company.
    - d. Plastic Oddities, Inc.

## 2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
  1. Known Acceptable Source:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Eclipse, Inc.

- d. Epco Sales, Inc.
  - e. Hart Industries, International, Inc.
  - f. Watts Industries, Inc.; Water Products Div.
  - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 psig minimum working pressure as required to suit system pressures.
- 1. Known Acceptable Source:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Epco Sales, Inc.
    - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- 1. Known Acceptable Source:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
- 1. Known Acceptable Source:
    - a. Perfection Corp.
    - b. Precision Plumbing Products, Inc.
    - c. Sioux Chief Manufacturing Co., Inc.

## 2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- 1. Known Acceptable Source:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Sealing Elements: EPDM, NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 3. Pressure Plates: Stainless steel. Include two for each sealing element.
  - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.



## 2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.

## 2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated .
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated .
- E. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

## 2.9 GROUT

- A. Description: ASTM C 1107, Grade B, no shrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
    - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.

- h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
  - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed or exposed-rivet hinge and .
  - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
  - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
  - l. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor slabs.
- P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
    - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
    - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
      - 1) Seal space outside of sleeve fittings with grout.
  - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
  - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
  - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble

mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- G. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
  - 3. PVC Nonpressure Piping: Join according to ASTM D 2855.
  - 4. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- H. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

### 3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### 3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

### 3.5 PAINTING

- A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

### 3.7 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 22 05 00

**SECTION 22 05 29**  
**HANGERS AND SUPPORTS FOR PLUMBING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following hangers and supports for plumbing system piping and equipment:
  - 1. Steel pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal-hanger shield inserts.
  - 5. Fastener systems.
  - 6. Equipment supports.

**1.2 DEFINITIONS**

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

**1.3 PERFORMANCE REQUIREMENTS**

- A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- B. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from COTR.

**1.4 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Steel pipe hangers and supports.
  - 2. Thermal-hanger shield inserts.
  - 3. Powder-actuated fastener systems.
- B. Welding certificates.

**1.5 QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
3. ASME Boiler and Pressure Vessel Code: Section IX.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other PART 2 articles where titles below introduce lists, the following requirements apply to product selection:
  1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

### 2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to PART 3 "HANGER AND SUPPORT APPLICATIONS" Article for where to use specific hanger and support types.
- B. Known Acceptable Source:
  1. B-Line Systems, Inc.; a division of Cooper Industries.
  2. Grinnell Corp.
  3. GS Metals Corp.
  4. National Pipe Hanger Corporation.
  5. Piping Technology & Products, Inc.
  6. Tolco Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

### 2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.



## 2.4 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Known Acceptable Source:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.
  - 2. Power-Strut Div.; Tyco International, Ltd.
  - 3. Thomas & Betts Corporation.
  - 4. Tolco Inc.
  - 5. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

## 2.5 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Known Acceptable Source:
  - 1. Carpenter & Paterson, Inc.
  - 2. ERICO/Michigan Hanger Co.
  - 3. PHS Industries, Inc.
  - 4. Pipe Shields, Inc.
  - 5. Rilco Manufacturing Company, Inc.
  - 6. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.6 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Known Acceptable Source:

- a. Hilti, Inc.
  - b. ITW Ramset/Red Head.
  - c. Masterset Fastening Systems, Inc.
  - d. MKT Fastening, LLC.
  - e. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- 1. Known Acceptable Source:
    - a. B-Line Systems, Inc.; a division of Cooper Industries.
    - b. Empire Industries, Inc.
    - c. Hilti, Inc.
    - d. ITW Ramset/Red Head.
    - e. MKT Fastening, LLC.
    - f. Powers Fasteners.

## 2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

## 2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
  2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
  3. Steel Pipe Clamps (MSS Type 4): For suspension of cold, NPS 1/2 to NPS 24, if little or no insulation is required.
  4. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
  6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  8. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
  9. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
  10. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
  11. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
  12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  13. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
  14. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
  15. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
  16. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
  17. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
  18. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  19. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

20. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- N. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

### 3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
  2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- N. Insulated Piping: Comply with the following:
1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
  2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees. Shields for all sizes of pipe shall include high-density insert material.
  - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
  - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
  - b. NPS 4: 12 inches long and 0.06 inch thick.
  - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
5. Insert Material:
  - a. Shall be high-density insulation (8 pcf or greater).
  - b. Shall be used on all sizes of insulated pipe at insulation shields.
  - c. Shall be full size of shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

### 3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1 inch.

### 3.5 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 22 05 29



THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 22 05 53**  
**IDENTIFICATION FOR PLUMBING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Equipment labels.
2. Pipe labels.
3. Valve tags.

**1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

**1.3 COORDINATION**

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

**PART 2 - PRODUCTS**

**2.1 EQUIPMENT LABELS**

**A. Metal Labels for Equipment:**

1. Material and Thickness: Brass, 0.032-inch or aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering

for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### 3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "PAINTING."
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
  - 1. Domestic Water Piping:
    - a. Background Color: Yellow.
    - b. Letter Color: White.
  - 2. Sanitary Waste and Storm Drainage Piping:
    - a. Background Color: White.
    - b. Letter Color: Black.

END OF SECTION 22 05 53

**SECTION 22 07 00**  
**PLUMBING INSULATION**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
  - a. Cellular glass.
  - b. Flexible elastomeric.
  - c. Mineral fiber.
2. Insulating cements
3. Adhesives
4. Mastics
5. Lagging adhesives
6. Sealants
7. Factory-applied jackets
8. Field-applied fabric-reinforcing mesh
9. Field-applied cloths
10. Field-applied jackets
11. Tapes
12. Securements
13. Corner angles

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Qualification Data: For qualified Installer.
- C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- D. Field quality-control reports.

### 1.3 QUALITY ASSURANCE

- A. **Installer Qualifications:** Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. **Fire-Test-Response Characteristics:** Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per 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 and inspecting agency.
  - 1. **Insulation Installed Indoors:** Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. **Packaging:** Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

### 1.5 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

### 1.6 SCHEDULING

- A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in PART 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- D. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cell-U-Foam Corporation; Ultra-CUF.
    - b. Pittsburgh Corning Corporation; Foamglas Super K.
  - 2. Block Insulation: ASTM C 552, Type I.
  - 3. Special-Shaped Insulation: ASTM C 552, Type III.
  - 4. Board Insulation: ASTM C 552, Type IV.
  - 5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
  - 6. Preformed Pipe Insulation with Factory-Applied ASJ or ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
  - 7. Factory fabricated shapes according to ASTM C 450 and ASTM C 585.
- E. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Aeroflex USA Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
    - d. Knauf Insulation; Duct Wrap.
    - e. Manson Insulation Inc.; Alley Wrap.
    - f. Owens Corning; All-Service Duct Wrap.
- F. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with



ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. CertainTeed Corp.; CrimpWrap.
  - b. Johns Manville; MicroFlex.
  - c. Knauf Insulation; Pipe and Tank Insulation.
  - d. Manson Insulation Inc.; AK Flex.
  - e. Owens Corning; Fiberglas Pipe and Tank Insulation.

## 2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Insulco, Division of MFS, Inc.; Triple I.
  - b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Insulco, Division of MFS, Inc.; SmoothKote.
  - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
  - c. Rock Wool Manufacturing Company; Delta One Shot.

## 2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

- B. Cellular-Glass Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Childers Products, Division of ITW; CP-96.

- b. Foster Products Corporation, H. B. Fuller Company; 81-33.
- 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Aeroflex USA Inc.; Aero seal.
    - b. Armacell LCC; 520 Adhesive.
    - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
    - d. RBX Corporation; Rubatex Contact Adhesive.
  - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.
  - 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.
  - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products, Division of ITW; CP-35.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
    - c. ITW TACC, Division of Illinois Tool Works; CB-50.
    - d. Marathon Industries, Inc.; 590.
    - e. Mon-Eco Industries, Inc.; 55-40.
    - f. Vimasco Corporation; 749.
  2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
  5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products, Division of ITW; CP-10.
    - b. Foster Products Corporation, H. B. Fuller Company; 35-00.
    - c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
    - d. Marathon Industries, Inc.; 550.
    - e. Mon-Eco Industries, Inc.; 55-50.
    - f. Vimasco Corporation; WC-1/WC-5.
  2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 200 deg F.
  4. Solids Content: 63 percent by volume and 73 percent by weight.
  5. Color: White.

## 2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products, Division of ITW; CP-52.
    - b. Foster Products Corporation, H. B. Fuller Company; 81-42.
    - c. Marathon Industries, Inc.; 130.
    - d. Mon-Eco Industries, Inc.; 11-30.
    - e. Vimasco Corporation; 136.
  3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.
  4. Service Temperature Range: Minus 50 to plus 180 deg F.
  5. Color: White.

## 2.6 SEALANTS

- A. Joint Sealants:
1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products, Division of ITW; CP-76.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-45.
    - c. Marathon Industries, Inc.; 405.
    - d. Mon-Eco Industries, Inc.; 44-05.
    - e. Pittsburgh Corning Corporation; Pittseal 444.
    - f. Vimasco Corporation; 750.
  2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Permanently flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 100 to plus 300 deg F.
  5. Color: White or gray.
  6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
    - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

## 2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto PVC Corporation; LoSmoke.
    - d. Speedline Corporation; SmokeSafe.
  2. Adhesive: As recommended by jacket material manufacturer.
  3. Color: Color-code jackets based on system. Color as selected by COR.
  4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45-and 90-degree, short-and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
  5. Factory-fabricated tank heads and tank side panels.

## 2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
    - b. Compac Corp.; 104 and 105.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - b. Compac Corp.; 110 and 111.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
    - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
  2. Width: 3 inches.
  3. Thickness: 6.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
    - b. Compac Corp.; 130.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.

- d. Venture Tape; 1506 CW NS.
  - 2. Width: 2 inches.
  - 3. Thickness: 6 mils.
  - 4. Adhesion: 64 ounces force/inch in width.
  - 5. Elongation: 500 percent.
  - 6. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    - b. Compac Corp.; 120.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
    - d. Venture Tape; 3520 CW.
  - 2. Width: 2 inches.
  - 3. Thickness: 3.7 mils.
  - 4. Adhesion: 100 ounces force/inch in width.
  - 5. Elongation: 5 percent.
  - 6. Tensile Strength: 34 lbf/inch in width.

## 2.10 SECUREMENTS

- A. Bands:
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products; Bands.
    - b. PABCO Metals Corporation; Bands.
    - c. RPR Products, Inc.; Bands.
  - 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
  - 3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
  - 4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. C & F Wire.
  - b. Childers Products.
  - c. PABCO Metals Corporation.
  - d. RPR Products, Inc.

## 2.11 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
  1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
  3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and prepare surfaces to be insulated. Remove materials that will adversely affect insulation application.
- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.



- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
  2. Testing agency labels and stamps.
  3. Nameplates and data plates.
  4. Manholes.
  5. Handholes.
  6. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Division 07 Section "PENETRATION FIRESTOPPING" Firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "PENETRATION FIRESTOPPING."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 CELLULAR-GLASS INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

### 3.7 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.

2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.8 MINERAL-FIBER INSULATION INSTALLATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

#### C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.9 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

### 3.10 FINISHES

A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 "PAINTING".

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
  - a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by COR. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

### 3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in plumbing access.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.12 INDOOR PIPING INSULATION SCHEDULE

#### A. Domestic Cold Water:

1. Insulation shall be one of the following:
  - a. Cellular Glass: 1-1/2 inches thick.
  - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  - c. Polyolefin: 1 inch thick.

#### B. Domestic Hot Water:

1. Insulation shall be one of the following:
  - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  - b. Polyolefin: 1 inch thick.

#### C. Exposed Sanitary Drains, Domestic Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:
  - a. Flexible Elastomeric: 3/4 inch thick.

#### D. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:
  - a. Polyolefin: 1 inch thick.

### 3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Equipment, Concealed and Exposed:
  1. PVC, Color-Coded by System: 20 mils thick.
- D. Piping, Concealed:



1. None.

E. Piping, Exposed:

1. PVC, Color-Coded by System: 20 mils thick.
2. Aluminum, Corrugated: 0.020 inch thick.

END OF SECTION 22 07 00

**SECTION 22 11 16**  
**DOMESTIC WATER PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Encasement for piping.
3. Specialty valves.
4. Flexible connectors.
5. Escutcheons.
6. Sleeves and sleeve seals.
7. Wall penetration systems.

**1.2 SUBMITTALS**

**A. Product Data:** For the following products:

1. Specialty valves.
2. Dielectric fittings.
3. Flexible connectors.
4. Backflow preventers and vacuum breakers.
5. Escutcheons.
6. Sleeves and sleeve seals.
7. Water penetration systems.

**B. Water Samples:** Specified in Section "Cleaning".

**C. Field quality-control reports.**

**1.3 QUALITY ASSURANCE**

**A. Piping materials shall bear label, stamp, or other markings of specified testing agency.**

**B. NSF Standard:** Comply with NSF 61, "Drinking Water System Components—Health Effects" for potable domestic water piping and components.

## PART 2 - PRODUCTS

### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

### 2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.
  - 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
  - 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
  - 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
  - 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.
  - 1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

### 2.3 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "GENERAL-DUTY VALVES FOR PLUMBING PIPING" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "DOMESTIC WATER PIPING SPECIALTIES" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

### 2.4 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Capitol Manufacturing Company.
    - b. Central Plastics Company.
    - c. EPCO Sales, Inc.

- d. Hart Industries International, Inc.
- e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- f. Zurn Plumbing Products Group; Wilkins Water Control Products.

2. Description:

- a. Pressure Rating: 150 psig at 180 deg F.
- b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Couplings:

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

- a. Calpico, Inc.
- b. Lochinvar Corporation.

2. Description:

- a. Galvanized-steel coupling.
- b. Pressure Rating: 300 psig at 225 deg F.
- c. End Connections: Female threaded.
- d. Lining: Inert and noncorrosive, thermoplastic.

D. Dielectric Nipples:

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

- a. Perfection Corporation; a subsidiary of American Meter Company.
- b. Precision Plumbing Products, Inc.

2. Description:

- a. Electroplated steel nipple complying with ASTM F 1545.
- b. Pressure Rating: 300 psig at 225 deg F.
- c. End Connections: Male threaded.
- d. Lining: Inert and noncorrosive, propylene.

## 2.5 FLEXIBLE CONNECTORS

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

- 1. Flex-Hose Co., Inc.

2. Flexicraft Industries.
3. Flex Pression, Ltd.
4. Flex-Weld, Inc.
5. Hyspan Precision Products, Inc.
6. Mercer Rubber Co.
7. Metraflex, Inc.
8. Proco Products, Inc.
9. Tozen Corporation.
10. Unaflex, Inc.
11. Universal Metal Hose; a Hyspan company

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

## 2.6 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.

C. One Piece, Deep Pattern: Deep-drawn, box-shaped brass with chrome-plated finish.

D. One Piece, Stamped Steel: Chrome-plated finish with setscrew or spring clips.

E. Split Casting, Cast Brass: Polished, chrome-plated finish with concealed hinge and setscrew.

F. Split Plate, Stamped Steel: Chrome-plated finish with concealed hinge, setscrew or spring clips.

G. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

H. Split-Casting Floor Plates: Cast brass with concealed hinge.

## 2.7 SLEEVES

A. Cast-Iron Wall Pipes: Fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with setscrews.

## 2.8 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Advance Products & Systems, Inc.
  - 2. Calpico, Inc.
  - 3. Metraflex, Inc.
  - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
  - 1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Stainless steel.
  - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

## 2.9 WALL PENETRATION SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. SIGMA.
- B. Description: Wall-sleeve assembly, consisting of housing and gland, gaskets, and pipe sleeve.
  - 1. Carrier-Pipe Deflection: Up to 5 percent without leakage.
  - 2. Housing: Ductile-iron casting with hub, waterstop, anchor ring, and locking devices. Include gland, bolts, and nuts.
  - 3. Housing-to-Sleeve Gasket: EPDM rubber or NBR.
  - 4. Housing-to-Carrier-Pipe Gasket: AWWA C111, EPDM rubber or NBR.
  - 5. Pipe Sleeve: AWWA C151, ductile-iron pipe or ASTM A 53/A 53M, Schedule 40, zinc-coated steel pipe.

## 2.10 GROUT

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

- A. Comply with requirements in Division 31 Section "EARTH MOVING" for excavating, trenching, and backfilling.

### 3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "METERS AND GAGES FOR PLUMBING PIPING" for pressure gages and Division 22 Section "DOMESTIC WATER PIPING SPECIALTIES" for drain valves and strainers.
- D. Install shutoff valve immediately upstream of each dielectric fitting.
- E. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- F. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- G. Install piping at right angles or parallel to building wall. Diagonal runs are prohibited unless specified otherwise.
- H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

- I. Install piping adjacent to equipment and specialties to allow service and maintenance.
- J. Install piping to permit valve servicing.
- K. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- L. Install piping free of sags and bends.
- M. Install fittings for changes in direction and branch connections.
- N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

### 3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### 3.4 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "GENERAL-DUTY VALVES FOR PLUMBING PIPING" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller.



### 3.5 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
  - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
  - 2. NPS 2 and Larger: Sleeve-type coupling.

### 3.6 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

### 3.7 FLEXIBLE CONNECTOR INSTALLATION

- A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.
- B. Install bronze-hose flexible connectors in copper domestic water tubing.
- C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

### 3.8 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT" for pipe hanger and support products and installation.
  - 1. Vertical Piping: MSS Type 8 or 42 clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer than 100 Feet if indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

### 3.9 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
  - 3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection.

### 3.10 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:
  - 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
  - 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast brass with polished chrome-plated finish or stamped steel with set screw or spring clips.
  - 3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece or split casting, cast brass with polished chrome-plated finish or one piece or split plate, stamped steel with set screw.
  - 4. Bare Piping in Unfinished Service Spaces: One piece, stamped steel with spring clips.
  - 5. Bare Piping in Equipment Rooms: One piece, stamped steel with set screw or spring clips.

6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

### 3.11 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "JOINT SEALANTS" for joint sealants.
- G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "JOINT SEALANTS" for joint sealants.
- H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using wall penetration systems specified in this Section.
- I. Seal space outside of sleeves in concrete slabs and walls with grout.
- J. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- K. Install sleeve materials according to the following applications:
  1. Sleeves for Piping Passing through Concrete Floor Slabs: Steel pipe.
  2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe.
    - a. Extend sleeves 2 inches above finished floor level.
    - b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements in Division 07 Section "SHEET METAL FLASHING AND TRIM" for flashing.
  3. Sleeves for Piping Passing through Gypsum-Board Partitions:
    - a. Steel pipe sleeves for pipes smaller than NPS 6.

- b. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
  - 4. Sleeves for Piping Passing through Concrete Roof Slabs: Steel pipe.
  - 5. Sleeves for Piping Passing through Exterior Concrete Walls:
    - a. Steel pipe sleeves for pipes smaller than NPS 6.
    - b. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
    - c. Do not use sleeves when wall penetration systems are used.
  - 6. Sleeves for Piping Passing through Interior Concrete Walls:
    - a. Steel pipe sleeves for pipes smaller than NPS 6.
- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "PENETRATION FIRESTOPPING" for firestop materials and installations.

### 3.12 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.13 WALL PENETRATION SYSTEM INSTALLATION

- A. Install wall penetration systems in new, exterior concrete walls.
- B. Assemble wall penetration system components with sleeve pipe. Install so that end of sleeve pipe and face of housing are flush with wall. Adjust locking devices to secure sleeve pipe in housing.

### 3.14 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT" for identification materials and installation.

### 3.15 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by FAA Resident Engineer.
2. During installation, notify FAA Contracting Officer Representative at least one day before inspection must be made. Perform tests specified below in presence of FAA Contracting Officer Representative:
  - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - b. Final Inspection: Arrange final inspection for FAA Contracting Officer Representative to observe tests specified below and to ensure compliance with requirements.
3. Re-inspection: If FAA Contracting Officer Representative finds that piping will not pass tests or inspections, make required corrections and arrange for re-inspection.
4. Reports: Prepare inspection reports and have them signed by FAA Contracting Officer Representative.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

### 3.16 ADJUSTING

- A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
  2. Open shutoff valves to fully open position.
  3. Open throttling valves to proper setting.
  4. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
  5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
  7. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.17 CLEANING

- A. Potable Water Systems: Flush and disinfect domestic potable water piping and fixtures as follows:
1. Initial Flush: Flush new piping, new fixtures and parts of existing piping and fixtures that have been altered, extended, or repaired with clean, potable water until dirty water does not appear at outlet(s).
  2. Disinfection: Use disinfection procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow disinfection process below:
    - a. Isolate system or part thereof through valving and fill with water/chlorine solution, raising chlorine level in isolated portions to at least 50 ppm (50 mg/L). Maintain this minimum chlorine level in the system for at least 24 hours; note chlorine residual levels in the system will decrease gradually over time. Alternatively, chlorine may be raised to at least 200 ppm for a minimum of three hours. Chlorine levels should be tested on-site at a minimum of 15% of the outlets.
    - b. Flush system with clean, potable water until chlorine residual level is equal to that of incoming water supply, which is approximately 1 ppm. Flush duration shall last at least 10 minutes at a minimum from each outlet.
  3. Laboratory Testing: The following sampling and laboratory testing procedure shall be performed after disinfecting and flushing the new system(s). Additional information regarding these procedures may be found in FAA Order No. JO 3900.61, Drinking Water Testing at Air Traffic Organization Facilities.
    - a. Sample Locations: Sample locations shall include all of the following:
      - 1) All drinking water sources (e.g., fountains, break rooms/kitchen sinks, coffee and soda machines, ice makers).
    - b. Note: Do not run water for a minimum of 6 hours prior to sampling.
    - c. First Draw Samples: A “first draw” sample shall be taken from each sampling location. This sample shall be taken from the first flow coming out of the fixture. First draw samples shall be tested by a certified lab for pH, lead, and copper.

- d. Flushed Samples: A second sample shall be taken from 10-percent of the sampling locations. These shall be “flushed” samples, taken after running water through the fixtures for at least 5 minutes. Flushed samples shall be tested by a certified lab for pH, lead, and copper, as well as total coliform.
- 4. Analyses of Laboratory Results: Test results will determine whether the new/modified system(s) may begin to be used for potable consumption. Maximum acceptable levels for lead and copper are 0.015 ppm (15 ppb) and 1.3 ppm, respectively. Total coliforms tests are acceptable if results show presence as negative.
  - a. If all test results indicate acceptable water quality, then the new/modified system(s) may begin to be used for potable consumption.
  - b. If laboratory results indicate that total coliforms are present in any flushed samples, then the disinfection and laboratory testing procedures shall be repeated; follow paragraphs 3.17.A.2 and 3.17.A.3 above, but re-sampling and re-testing only for total coliforms in flushed samples. If second round of laboratory testing indicates an unacceptable level of total coliform, notify COR and await further instruction.
  - c. If laboratory results indicate unacceptable lead and/or copper concentrations in any fixture, follow the procedure outlined below.
    - 1) Flush the contaminated fixture for a minimum of 10 minutes at the highest flow rate operable through the fixture. After this initial flush, then run water through the fixture at a low flow rate for 72 hours; this is referred to as the conditioning period. The low flow rate should be just a trickle, on the order 1 to 3 gallons per hour (i.e., 2-6 fluid ounces per minute).
    - 2) After conditioning, remove, clean and reinstall any strainers on piping and in fixture leading to the fixture outlet. Also remove, clean and reinstall any faucet aerators. Metal debris corroded from the new system can become caught on these elements.
    - 3) Repeat laboratory test procedure; follow paragraph 3.17.A.3 above, but testing only for lead and/or copper as appropriate from the contaminated fixture. Second round of testing shall include both first draw and flushed samples, regardless of whether only one sample showed an unacceptable level during the previous round of sampling. If the second round of laboratory testing indicates unacceptable levels of lead and/or copper in any sample, notify COR and await further instruction.
- B. Stagnant Potable Water Systems: If potable domestic water piping and fixtures are not used or building is unoccupied for more than 10 days after initial cleaning, flush system with clean, potable water for a minimum of 10 minutes prior to using for potable consumption. If piping and fixtures are not used or building is unoccupied for more than 30 days after initial cleaning, repeat the flush, disinfection, testing and re-testing procedures outlined in paragraph 3.17.A of this document prior to using for potable consumption.
- C. Post-Installation Alterations and Repairs: If the potable domestic water system or any part thereof is altered or repaired after initial cleaning, an additional cleaning, testing and re-testing of the system or part must be accomplished as outlined in paragraph 3.17.A of this document prior to use.

- D. Non-Potable Water Systems: Flush new piping, new fixtures, and parts of existing piping and fixtures that have been altered, extended, or repaired with clean water until dirty water does not appear at outlets.
- E. Reporting: Prepare and submit reports of all flushing and disinfecting activities to the COR. All laboratory test results from sampling activities shall be provided to the COR upon receipt of the results from the certified laboratory.

### 3.18 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building service piping, NPS 3 and smaller, shall be the following:
  - 1. Hard or soft copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings; and brazed joints.
- E. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
  - 1. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; cast- or wrought-copper solder-joint fittings; and brazed or soldered joints.

### 3.19 VALVE SCHEDULE

- F. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use ball or gate valves with flanged ends for piping NPS 2-1/2 and larger.
  - 2. Throttling Duty: Use ball valves for piping NPS 2 and smaller.
  - 3. Drain Duty: Hose-end drain valves.
- G. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 22 11 16



**SECTION 22 11 19**  
**DOMESTIC WATER PIPING SPECIALTIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following domestic water piping specialties:
  - 1. Vacuum breakers.
  - 2. Backflow preventers.
  - 3. Strainers.
  - 4. Outlet boxes.
  - 5. Hose bibbs.
  - 6. Wall hydrants.
  - 7. Drain valves.
  - 8. Water hammer arresters.
  - 9. Air vents.

**1.2 PERFORMANCE REQUIREMENTS**

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

**1.3 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

**1.4 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. NSF Compliance:
  - 1. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

## PART 2 - PRODUCTS

### 2.1 VACUUM BREAKERS

#### A. Hose-Connection Vacuum Breakers HB:

1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Arrowhead Brass Products, Inc.
  - b. Cash Acme.
  - c. Conbraco Industries, Inc.
  - d. Legend Valve.
  - e. MIFAB, Inc.
  - f. Prier Products, Inc.
  - g. Watts Industries, Inc.; Water Products Div.
  - h. Woodford Manufacturing Company.
  - i. Zurn Plumbing Products Group; Light Commercial Operation.
  - j. Zurn Plumbing Products Group; Wilkins Div.
3. Standard: ASSE 1011.
4. Body: Bronze, nonremovable, with manual drain.
5. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
6. Finish: Chrome or nickel plated.

### 2.2 BACKFLOW PREVENTERS

#### A. Reduced-Pressure-Principle Backflow Preventers RP2BFP:

1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Ames Co.
  - b. Conbraco Industries, Inc.
  - c. FEBCO; SPX Valves & Controls.
  - d. Flomatic Corporation.
  - e. Watts Industries, Inc.; Water Products Div.
  - f. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Size: 1/211

6. Design Flow Rate: 5GPM
7. Selected Unit Flow Range Limits: 5
8. Pressure Loss at Design Flow Rate: 11psig for sizes NPS 2 and smaller
9. Body: Bronze for NPS 2 and smaller
10. End Connections: Threaded for NPS 2 and smaller
11. Configuration: Designed for horizontal flow.
12. Accessories:
  - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller
  - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

**B. Double-Check Backflow-Prevention Assemblies (DCV BFP)**

1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Ames Co.
  - b. Conbraco Industries, Inc.
  - c. FEBCO; SPX Valves & Controls.
  - d. Flomatic Corporation.
  - e. Watts Industries, Inc.; Water Products Div.
  - f. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: 6 psig maximum, through middle 1/3 of flow range.
5. Size: 2" NPS.
6. Design Flow Rate: 63 gpm.
7. Selected Unit Flow Range Limits: 80 gpm.
8. Pressure Loss at Design Flow Rate: 5 psig for sizes NPS 2 and smaller.
9. Body: Bronze for NPS 2 and smaller.
10. End Connections: Threaded for NPS 2 and smaller.
11. Configuration: Designed for vertical, straight through flow.
12. Accessories:
  - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller.

**C. Hose-Connection Backflow Preventers HB:**

1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Conbraco Industries, Inc.
  - b. Watts Industries, Inc.; Water Products Div.

- c. Woodford Manufacturing Company.
- 2. Standard: ASSE 1052.
- 3. Operation: Up to 10-foot head of water back pressure.
- 4. Inlet Size: NPS 1/2 or NPS 3/4.
- 5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
- 6. Capacity: At least 3-gpm flow.

## 2.3 STRAINERS FOR DOMESTIC WATER PIPING

### A. Y-Pattern Strainers:

- 1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
- 2. Body: Bronze for NPS 2 and smaller; cast iron
- 3. End Connections: Threaded for NPS 2 and smaller.
- 4. Screen: Stainless steel with round perforations, unless otherwise indicated.
- 5. Perforation Size:
  - a. Strainers NPS 2 and Smaller: 0.020 inch
- 6. Drain: Factory-installed, hose-end drain valve.

### B. Icemaker Outlet Boxes:

- 1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Acorn Engineering Company.
  - b. IPS Corporation.
  - c. LSP Products Group, Inc.
  - d. Oatey.
  - e. Plastic Oddities; a division of Diverse Corporate Technologies.
- 2. Mounting: Recessed.
- 3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
- 4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
- 5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

## 2.4 HOSE BIBBS

### A. Hose Bibbs HB:

- 1. Standard: ASME A112.18.1 for sediment faucets.
- 2. Body Material: Bronze.

3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: field-installation nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle
13. Operation for Finished Rooms: Wheel handle
14. Include operating key with each operating-key hose bibb.

## 2.5 WALL HYDRANTS

### A. Nonfreeze Wall Hydrants (NFHB)

1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Josam Company.
  - b. MIFAB, Inc.
  - c. Prier Products, Inc.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - e. Tyler Pipe; Wade Div.
  - f. Watts Drainage Products Inc.
  - g. Woodford Manufacturing Company.
  - h. Zurn Plumbing Products Group; Light Commercial Operation.
  - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
9. Box and Cover Finish: Polished nickel bronze
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze
12. Operating Key(s): Two with each wall hydrant.

## 2.6 WATER HAMMER ARRESTERS

### A. Water Hammer Arresters (WHA'A'-WHA'C')

1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. AMTROL, Inc.
  - b. Josam Company.
  - c. MIFAB, Inc.
  - d. PPP Inc.
  - e. Sioux Chief Manufacturing Company, Inc.
  - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - g. Tyler Pipe; Wade Div.
  - h. Watts Drainage Products Inc.
  - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

## 2.7 AIR VENTS

### A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 1/2 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Refer to Division 22 Section "COMMON WORK RESULTS FOR PLUMBING" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with FAA Resident Engineer.
  1. Locate backflow preventers in same room as connected equipment or system.

2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
  3. Do not install bypass piping around backflow preventers.
- C. Install water hammer arresters in water piping according to PDI-WH 201.
  - D. Install air vents at high points of water piping.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 26 Section "GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS."

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
  1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer according to FAA Contracting Officer Representative and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

END OF SECTION 22 11 19

THIS PAGE INTENTIONALLY LEFT BLANK



**SECTION 22 11 23  
NATURAL GAS PIPING**

**PART 1- GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Grout.
7. Concrete bases.

**1.2 DEFINITIONS**

- A. Finished Spaces:** Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations:** Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations:** Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Natural-Gas System Pressure:** More than 0.5 psig but not more than 2 psig

**1.4 SUBMITTALS**

**A. Product Data:** For each type of the following:

1. Piping specialties.
2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Dielectric fittings.
6. Mechanical sleeve seals.
7. Escutcheons.

- B. Welding certificates.
- C. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### PART 2 - PRODUCTS

#### 2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type S, Grade B.
  - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
  - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
  - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
  - 4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
    - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

#### 2.2 PIPING SPECIALTIES

- A. Appliance Flexible Connectors:
  - 1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
  - 2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.

#### 2.3 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate

for wall thickness and chemical analysis of steel pipe being welded.

## 2.4 MANUAL GAS SHUTOFF VALVES

### A. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Lee Brass Company.
  - b. McDonald, A. Y. Mfg. Co.
2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
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.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

## 2.5 DIELECTRIC FITTINGS

### A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Capitol Manufacturing Company.
  - b. Central Plastics Company.
  - c. Hart Industries International, Inc.
  - d. McDonald, A. Y. Mfg. Co.
  - e. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
  - f. Wilkins; Zurn Plumbing Products Group.
2. Combination fitting of copper alloy and ferrous materials.

## 2.6 SLEEVES

- ### A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

## 2.7 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

### 3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade.
  - 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Steel Piping with Protective Coating:
  - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
  - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating

- 3. Replace pipe having damaged PE coating with new pipe.
  - E. Install fittings for changes in direction and branch connections.
  - F. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - G. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- H. Install pressure gage downstream from each service regulator.

#### 3.4 INDOOR PIPING INSTALLATION

- A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Section 07 84 13 "Penetration Firestopping."
- L. Verify final equipment locations for roughing-in.

- M. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- N. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
  - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- Q. Connect branch piping from top or side of horizontal piping.
- R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- S. Do not use natural-gas piping as grounding electrode.

### 3.5 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
- B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

### 3.6 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
  - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
  - 2. Cut threads full and clean using sharp dies.
  - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
  - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
  - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or

damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hangers and supports specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
  1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
  5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.8 CONNECTIONS

- A. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- B. Install piping adjacent to appliances to allow service and maintenance of appliances.
- C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 PAINTING

- A. Comply with requirements in Division 9 painting Sections for painting interior and exterior natural-gas piping.

3.11 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 23 11 23



**SECTION 22 13 16**  
**SANITARY WASTE AND VENT PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following for soil, waste, and vent piping inside the building:
  - 1. Pipe, tube, and fittings.
  - 2. Special pipe fittings.
  - 3. Encasement for underground metal piping.

**1.2 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. LLDPE: Linear, low-density polyethylene plastic.
- D. NBR: Acrylonitrile-butadiene rubber.
- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.
- G. TPE: Thermoplastic elastomer.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

**1.4 SUBMITTALS**

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field quality-control inspection and test reports.

## 1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

## 1.6 COORDINATION DRAWINGS

- A. Coordination Drawings: Drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved. At a minimum, these drawings shall be submitted in plan view. Single line drawings are not acceptable:
  - 1. Domestic water piping.
  - 2. HVAC Equipment and Duct.
  - 3. Sanitary Sewer Piping.
  - 4. Structural Members.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other PART 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

### 2.2 PIPING MATERIALS

- A. Refer to PART 3 "PIPING APPLICATIONS" Article for applications of pipe, tube, fitting, and joining materials.

### 2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Extra-Heavy class.
- B. Gaskets: ASTM C 564, rubber.

### 2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
  - a. Known Acceptable Source:
    - 1) ANACO.
    - 2) Clamp-All Corp.
    - 3) Ideal Div.; Stant Corp.
    - 4) Mission Rubber Co.
    - 5) Tyler Pipe; Soil Pipe Div.

## 2.5 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, Type S, Grade B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.
- B. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.
- C. Pressure Fittings:
  1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
  2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
  3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
  4. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.

## 2.6 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
  1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- B. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
  1. Known Acceptable Source:
    - a. SIGMA Corp.

## PART 3 - EXECUTION

### 3.1 EXCAVATION

- A. Refer to Division 31 Section "EARTH MOVING" for excavating, trenching, and backfilling.

### 3.2 PIPING APPLICATIONS

- A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
  - 1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
  - 2. Steel pipe, drainage fittings, and threaded joints.
  - 3. Copper DWV tube, copper drainage fittings, and soldered joints.
  - 4. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
  - 1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
  - 2. Steel pipe, drainage fittings, and threaded joints.
  - 3. Copper DWV tube, copper drainage fittings, and soldered joints.
    - a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.
  - 4. Dissimilar Pipe-Material Couplings: Flexible nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
  - 1. Extra-Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
  - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

### 3.3 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "COMMON WORK RESULTS FOR PLUMBING."
- B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "COMMON WORK RESULTS FOR PLUMBING."
- D. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.
- E. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- H. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
  - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- I. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- J. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### 3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "COMMON WORK RESULTS FOR PLUMBING."

- B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 Section "HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Install individual, straight, horizontal piping runs according to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
- H. Install supports for vertical copper tubing every 10 feet.

- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
  - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

### 3.7 FIELD QUALITY CONTROL

- A. During installation, notify FAA Contracting Officer Representative at least 24 hours before inspection must be made. Perform tests specified below in presence of FAA Contracting Officer Representative.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by FAA Contracting Officer Representative to observe tests specified below and to ensure compliance with requirements.
- B. Re-inspection: If FAA Contracting Officer Representative finds that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
- C. Reports: Prepare inspection reports and have them signed by FAA Contracting Officer Representative.
- D. Test sanitary drainage and vent piping according to procedures of FAA Contracting Officer Representative or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

### 3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 22 13 16



**SECTION 22 13 19**  
**SANITARY WASTE PIPING SPECIALTIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following sanitary drainage piping specialties:
  - 1. Cleanouts.
  - 2. Floor drains.
  - 3. Through-penetration firestop assemblies.
  - 4. Miscellaneous sanitary drainage piping specialties.
  - 5. Flashing materials.

**1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:
  - 1. Clean outs.
  - 2. Floor drains
- B. Field quality-control test reports.

**1.3 QUALITY ASSURANCE**

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

**1.4 COORDINATION**

- A. Coordinate size and location of roof penetrations.

## PART 2 - PRODUCTS

### 2.1 CLEANOUTS

#### A. Exposed Metal Cleanouts CO plug:

1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products Inc.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
  - g. Josam Company; Blucher-Josam Div.
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

#### B. Metal Floor Cleanouts FCO:

1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Josam Company; Josam Div.
  - b. Oatey.
  - c. Sioux Chief Manufacturing Company, Inc.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - e. Tyler Pipe; Wade Div.
  - f. Watts Drainage Products Inc.
  - g. Zurn Plumbing Products Group; Light Commercial Operation.
  - h. Zurn Plumbing Products Group; Specification Drainage Operation.
  - i. Josam Company; Josam Div.
  - j. Kusel Equipment Co.
2. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Cast-iron soil pipe with cast-iron ferrule.
5. Body or Ferrule: Cast iron
6. Clamping Device: Not required

7. Outlet Connection: Spigot
8. Closure: Brass plug with tapered threads
9. Adjustable Housing Material: Cast iron with threads
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy
11. Frame and Cover Shape: Round
12. Top Loading Classification: Heavy Light Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
14. Standard: ASME A112.3.1.
15. Size: Same as connected branch.

C. Cast-Iron Wall Cleanouts WCO:

1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products Inc.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

## 2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains FD-1

1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Commercial Enameling Co.
  - b. Josam Company; Josam Div.
  - c. MIFAB, Inc.
  - d. Prier Products, Inc.
  - e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - f. Tyler Pipe; Wade Div.
  - g. Watts Drainage Products Inc.
  - h. Zurn Plumbing Products Group; Light Commercial Operation.

- i. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 2. Standard: ASME A112.6.3
  - 3. Pattern: Floor Sanitary drain.
  - 4. Body Material: Gray iron
  - 5. Seepage Flange: Required
  - 6. Anchor Flange: Required
  - 7. Clamping Device: Not required
  - 8. Outlet: Bottom
  - 9. Backwater Valve: Not required
  - 10. Coating on Interior and Exposed Exterior Surfaces: Not required
  - 11. Sediment Bucket: FD-2
  - 12. Top or Strainer Material: Nickel bronze
  - 13. Top Shape: Round FD-1 and FD-2
  - 14. Dimensions of Top or Strainer: (FD-1) 6” Diameter, nickel bronze, (FD-2) 10”sq, nickel bronze sump, and grate.
  - 15. Top Loading Classification: Heavy Duty Light Duty
  - 16. Trap Material: Cast iron
  - 17. Trap Pattern: Deep-seal P-trap
  - 18. Trap Features: Trap-seal primer valve drain connection

## 2.3 ROOF FLASHING ASSEMBLIES

### A. Roof Flashing Assemblies:

- 1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Acorn Engineering Company; Elmdor/Stoneman Div.
  - b. Thaler Metal Industries Ltd.

### B. Description: Manufactured assembly made of thick, copper or galvanized steel flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

- 1. Open-Top Vent Cap: Without cap.
- 2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
- 3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

## 2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

### A. Through-Penetration Firestop Assemblies:

- 1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating: Corrosion resistant on interior of fittings.

## 2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

### A. Stack Flashing Fittings:

1. Description: Counter flashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

### B. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

### C. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

## 2.6 FLASHING MATERIALS

### A. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft.
2. Vent Pipe Flashing: 8 oz./sq. ft.

### B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

### C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

### D. Fasteners: Metal compatible with material and substrate being fastened.

- E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- F. Solder: ASTM B 32, lead-free alloy.
- G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Refer to Division 22 Section "COMMON WORK RESULTS FOR PLUMBING" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate at each change in direction of piping greater than 45 degrees.
  - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller.
  - 4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  - 1. Position floor drains for easy access and maintenance.
  - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
  - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

- H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
  - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
  - 2. Size: Same as floor drain inlet.
- I. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- J. Install vent caps on each vent pipe passing through roof.
- K. Install steel reinforcement for wall-mounting-type specialties.
- L. Install traps on plumbing specialty drain outlets.
- M. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS."

### 3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
  - 1. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
  - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
  - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
  - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.

- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "SHEET METAL FLASHING AND TRIM."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

### 3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### 3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

### 3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain equipment Refer to Division 01.

END OF SECTION 22 13 19



**SECTION 22 40 00**  
**PLUMBING FIXTURES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following conventional plumbing fixtures and related components:
1. Faucets for lavatories, showers and sinks.
  2. Toilet seats.
  3. Protective shielding guards.
  4. Fixture supports.
  5. Disposers.
  6. Water closets.
  7. Urinals.
  8. Lavatories.
  9. Kitchen sinks.
  10. Service basins.

**1.2 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
- D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
- E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- F. FRP: Fiberglass-reinforced plastic.
- G. PMMA: Polymethyl methacrylate (acrylic) plastic.
- H. PVC: Polyvinyl chloride plastic.
- I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

### 1.3 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.

### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
  - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
  - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
  - 2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
  - 3. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
  - 4. Stainless-Steel Residential Sinks: ASME A112.19.3.
  - 5. Vitreous-China Fixtures: ASME A112.19.2M.
  - 6. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.

H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
4. Faucets: ASME A112.18.1.
5. Hose-Connection Vacuum Breakers: ASSE 1011.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
8. NSF Potable-Water Materials: NSF 61.
9. Pipe Threads: ASME B1.20.1.
10. Battery Operated Sensor-Actuated Faucets: UL 1951.
11. Supply Fittings: ASME A112.18.1.
12. Brass Waste Fittings: ASME A112.18.2.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1.
3. Dishwasher Air-Gap Fittings: ASSE 1021.
4. Plastic Tubular Fittings: ASTM F 409.
5. Brass Waste Fittings: ASME A112.18.2.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.
2. Dishwasher Air-Gap Fittings: ASSE 1021.
3. Flexible Water Connectors: ASME A112.18.6.
4. Floor Drains: ASME A112.6.3.
5. Grab Bars: ASTM F 446.
6. Hose-Coupling Threads: ASME B1.20.7.
7. Off-Floor Fixture Supports: ASME A112.6.1M.
8. Pipe Threads: ASME B1.20.1.
9. Plastic Toilet Seats: ANSI Z124.5.
10. Supply and Drain Protective Shielding Guards: ICC A117.1.

## 1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.

2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
3. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
4. Water-Closet Tank, Repair Kits: Equal to 5 percent of amount of each type installed.

## PART 2 - PRODUCTS

### 2.1 LAVATORY FAUCETS

#### A. Lavatory Faucets:

1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. American Standard Companies, Inc.
  - b. Bradley Corporation.
  - c. Chicago Faucets.
  - d. Delta Faucet Company.
  - e. Eljer.
  - f. Elkay Manufacturing Co.
  - g. Fisher Manufacturing Co.
  - h. Grohe America, Inc.
  - i. Just Manufacturing Company.
  - j. Kohler Co.
  - k. Moen, Inc.
  - l. Royal Brass Mfg. Co.
  - m. Sayco; a Briggs Plumbing Products, Inc. Company.
  - n. Speakman Company.
  - o. T & S Brass and Bronze Works, Inc.
  - p. Zurn Plumbing Products Group; Commercial Brass Operation.
2. Description: Battery operated sensor activated valve. Coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
  - a. Body Material: General-duty, solid brass.
  - b. Finish: Polished chrome plate.
  - c. Maximum Flow Rate: 0.5 gpm.
  - d. Maximum Flow: 0.25 gal.
  - e. Centers: 4 inches.
  - f. Mounting: Deck, exposed.
  - g. Valve Handle(s): Not applicable.
  - h. Inlet(s): NPS 1/2 male shank.
  - i. Spout: Rigid type.
  - j. Spout Outlet: Aerator.

- k. Operation: Sensor.
- l. Drain: Grid.
- m. Tempering Device: Mechanical.

## 2.2 SINK FAUCETS

### A. Sink Faucets, Base Bldg:

- 1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. American Standard Companies, Inc.
  - b. Bradley Corporation.
  - c. Broadway Collection.
  - d. Chicago Faucets.
  - e. Delta Faucet Company.
  - f. Dormont Manufacturing Company.
  - g. Eljer.
  - h. Elkay Manufacturing Co.
  - i. Fisher Manufacturing Co.
  - j. Grohe America, Inc.
  - k. Just Manufacturing Company.
  - l. Kohler Co.
  - m. Moen, Inc.
  - n. Royal Brass Mfg. Co.
  - o. Sayco; a Briggs Plumbing Products, Inc. Company.
  - p. Speakman Company.
  - q. T & S Brass and Bronze Works, Inc.
  - r. Zurn Plumbing Products Group; Commercial Brass Operation.

## 2.3 TOILET SEATS

### A. Toilet Seats:

- 1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. American Standard Companies, Inc.
  - b. Bemis Manufacturing Company.
  - c. Centoco Manufacturing Corp.
  - d. Church Seats.
  - e. Eljer.
  - f. Kohler Co.
  - g. Olsonite Corp.
  - h. Sanderson Plumbing Products, Inc.; Beneke Div.

- i. Sper
- 2. Description: Toilet seat for water-closet-type fixture.
  - a. Material: Molded, solid plastic.
  - b. Configuration: Open front without cover.
  - c. Size: Elongated.
  - d. Hinge Type: SC, self-sustaining, check.
  - e. Class: Heavy-duty commercial.
  - f. Color: White.

## 2.4 PROTECTIVE SHIELDING GUARDS

### A. Protective Shielding Pipe Covers, Base Bldg. – (P8); Tower – (P13):

- 1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Engineered Brass Co.
  - b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
  - c. McGuire Manufacturing Co., Inc.
  - d. Plumberex Specialty Products Inc.
  - e. TCI Products.
  - f. TRUEBRO, Inc.
  - g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.
- 2. Description: Manufactured plastic wraps for covering plumbing fixture hot-and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

### B. Protective Shielding Piping Enclosures, Base Bldg. (P3H):

- 1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. TRUEBRO, Inc.
- 2. Description: Manufactured plastic enclosure for covering plumbing fixture hot-and cold-water supplies and trap and drain piping. Comply with ADA requirements.

## 2.5 FIXTURE SUPPORTS

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

1. Josam Company.
2. MIFAB Manufacturing Inc.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
6. Zurn Plumbing Products Group; Specification Drainage Operation.
- 7.

## 2.6 DISPOSERS

### A. Disposers:

1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. American Standard Companies, Inc.
  - b. Franke Consumer Products, Inc.; Kitchen Systems Div.
  - c. In-Sink-Erator; a div. of Emerson Electric Co.
  - d. KitchenAid.
  - e. Maytag Co.
  - f. Anaheim Manufacturing, Inc.; a Subsidiary of Western Industries, Inc.
  - g. WhiteRock Corp.
2. Description: Continuous-feed household, food-waste disposer. Include reset button; wall switch; corrosion-resistant chamber with jam-resistant, cutlery- or stainless-steel grinder or shredder; NPS 1-1/2 outlet; quick-mounting, stainless-steel sink flange; antisplash guard; and combination cover/stopper.
  - a. Type: Continuous-feed household.
  - b. Model: Sound-insulated chamber and stainless-steel outer shell.
  - c. Motor: 115-V ac, 1725 rpm, 3/4 hp with overload protection.
  - d. Heating Element: 750 W minimum, 115-V ac.

## 2.7 WATER CLOSETS

### A. Water Closets:

1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. American Standard Companies, Inc.
  - b. Barclay Products, Ltd.
  - c. Briggs Plumbing Products, Inc.
  - d. Crane Plumbing, L.L.C./Fiat Products.
  - e. Duravit USA, Inc.

- f. Eljer.
  - g. Gerber Plumbing Fixtures LLC.
  - h. Kohler Co.
  - i. Mansfield Plumbing Products, Inc.
  - j. Peerless Pottery, Inc.
  - k. Sanitarios Azteca, S.A. de C.V.
  - l. Sterling Plumbing Group, Inc.
  - m. St. Thomas Creations.
  - n. TOTO USA, Inc.
  - o. Water Management, Inc.
  - p. Capizzi.
  - q. St. Thomas Creations.
  - r. Kohler Co.
2. Description: Accessible, floor-mounting, floor-outlet, vitreous-china fixture designed for gravity-type tank operation.
- a. Style: Close coupled
    - 1) Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
    - 2) Height: Accessible.
    - 3) Design Consumption: 1.6 gal./flush.
    - 4) Tank: Gravity type with trim. Include cover.
    - 5) Trip Mechanism: Lever-handle actuator.
    - 6) Color: White.
  - b. Supply: NPS 1/2 chrome-plated brass or copper with wheel-handle stop.
  - c. Style: Flushometer valve.
    - 1) Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
    - 2) Height: Accessible.
    - 3) Design Consumption: 1.6 gal./flush.
    - 4) Color: White.

B. Lavatories:

- 1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Commercial Enameling Company.
  - b. Eljer.
  - c. Kohler Co.
  - d. Sterling Plumbing Group, Inc.
  - e. Benjamin Manufacturing Co., Inc.
  - f. Royal Baths Manufacturing Co.



- g. American Standard Companies, Inc.
- h. Bootz Plumbingware Co.
- i. Briggs Plumbing Products, Inc.
- j. Crane Plumbing, L.L.C./Fiat Products.
- k. Mansfield Plumbing Products, Inc.
- l. Avonite, Inc.
- m. Bradley Corporation.
- n. DuPont, Corian Products.
- o. Formica Corporation.
- p. Franke Consumer Products, Inc., Kitchen Systems Div.
- q. Lippert Corporation.
- r. Rynone Manufacturing Corp.
- s. Swan Corporation (The).

2. Description: Accessible Counter-mounting vitreous-china fixture.

- a. Type: Self-rimming.
- b. Oval Lavatory Size: 19 by 16 inches.
- c. Faucet Hole Punching Three holes, 2-inch centers.
- d. Faucet Hole Location: Top.
- e. Color: White.
- f. Faucet: Lavatory (P3H) for separate drain.
- g. Supplies: NPS 3/8 chrome-plated copper with stops.
- h. Drain: Grid.
- i. Drain Piping: NPS 1-1/4 chrome-plated, cast-brass P-trap; 0.045-inch-thick tubular brass waste to wall; and wall escutcheon.
- j. Protective Shielding Guard(s): (P3H)

2.8 BREAK ROOM SINK

A. Two-compartment Sink:

- 1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Commercial Enameling Company.
  - b. Eljer.
  - c. Jacuzzi, Inc.
  - d. Kohler Co.
  - e. Gerber Plumbing Fixtures LLC.
  - f. Lyons Industries, Inc.
  - g. American Standard Companies, Inc.
  - h. Bootz Plumbing ware Co.
  - i. Briggs Plumbing Products, Inc.
  - j. Eljer.
  - k. Mansfield Plumbing Products, Inc.

- l. Avonite, Inc.
  - m. DuPont, Corian Products.
  - n. FHP Kindred USA.
  - o. Formica Corporation.
  - p. Franke Consumer Products, Inc., Kitchen Systems Div.
  - q. Lippert Corporation.
  - r. Rynone Manufacturing Corp.
  - s. Swan Corporation (The).
  - t. Wilsonart International.
  - u. Just Manufacturer. (DL-ADA-2133-A-GR)
2. Description: Two -bowl, residential, counter-mounting, stainless-steel two-compartment sink ADA accessible.
- a. Overall Dimensions: 21" x 33.
  - b. Metal Thickness: 18 gauge.
  - c. Left Bowl:
    - 1) Dimensions: 16" x 14"
    - 2) Drain: 3-1/2-inch crumb cup.
      - a) Location: Center rear in compartment.
  - d. Right Bowl:
    - 1) Dimensions: 16" x 14"
    - 2) Drain: 3-1/2-inch crumb cup with offset waste outlet for disposer.
      - a) Location: Center rear in compartment.
  - e. Supplies: NPS 1/2 chrome-plated copper with stops.
  - f. Drain Piping: NPS 1-1/2 chrome-plated, cast-brass P-trap; 0.045-inch- thick tubular brass waste to wall and wall escutcheon(s).
  - g. Disposer.

## 2.9 SERVICE SINKS

### A. Service Sinks:

- 1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. American Standard Companies, Inc.
  - b. Commercial Enameling Company.
  - c. Eljer.
  - d. Kohler Co.

2. Description: Floor-mounting, enameled, cast-iron fixture with front apron, raised back, and coated, wire rim guard.
  - a. Size: 28 by 28 inches.
  - b. Color: White.
  - c. Faucet
  - d. Drain: Grid with NPS 3 outlet.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
  1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
  2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
  3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install counter-mounting fixtures in and attached to casework.
- G. Install fixtures level and plumb according to roughing-in drawings.
- H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "GENERAL-DUTY VALVES FOR PLUMBING PIPING."
- I. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
  - J. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
  - K. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
  - L. Install toilet seats on water closets.
  - M. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
  - N. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
  - O. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
  - P. Install traps on fixture outlets.
    1. Exception: Omit trap on fixtures with integral traps.
    2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
  - Q. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
  - R. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "COMMON WORK RESULTS FOR PLUMBING."
  - S. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "JOINT SEALANTS."
- 3.3 CONNECTIONS
- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
  - B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

- C. Ground equipment according to Division 26 Section "GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS."

### 3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

### 3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposer and controls. Replace damaged and malfunctioning units controls.
- C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- D. Replace washers and seals of leaking and dripping faucets and stops.
- E. Install fresh batteries in sensor-operated mechanisms.

### 3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
  - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
  - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 40 00

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 23 05 00**  
**COMMON WORK RESULTS FOR HVAC**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Equipment installation requirements common to equipment sections.
  - 2. Painting and finishing.
  - 3. Supports and anchorages.
- B. Contractor Qualifications: The Contractor shall have a permanent mailing and street address, telephone number and shall have been in continual business of HVAC systems for not less than 5 years. The Contractor shall be duly licensed to install HVAC systems in the state where the construction is located. The Contractor shall be a member in good standing with the General or Mechanical Contractors Association. The Contractor shall have previous HVAC system replacement experience with the FAA.
- C. General: Work shall be performed in accordance with these specifications and good practice. No modifications to these specifications will be accepted without the expressed written approval of the FAA. It is the Contractor's responsibility to document FAA's approval of any such modifications prior to the execution of work. Requirements of these Specifications modified by any addenda, change orders, written approvals and written instructions issued by the FAA, if any, shall be as specifically identified by Section and Paragraph in those addenda, change orders, written approvals and written instructions. Approvals of submittals are subject to additional limitations described elsewhere in these Specifications. System concept drawing sheets are for information only to show potential system arrangement. Field verify information contained on these drawings and is responsible for design and installation of the system in accordance with the specifications. The bid drawings do not show all information necessary for installation of the system, but are intended to be used as a guide for the purpose of designing the systems and preparing a bid.
- D. Removal of Debris and Salvage: Remove rubbish and debris resulting from work on a daily basis. Debris shall be disposed of offsite. Removal of debris and rubbish from the premises shall be coordinated with the FAA.

**1.2 DEFINITIONS**

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

### 1.3 SUBMITTALS

- A. Product Data: For the following:
  - 1. Supports.
  - 2. Grout.

### 1.4 QUALITY ASSURANCE

- A. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

### 1.6 COORDINATION

- A. Arrange for duct spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
- B. Coordinate installation of required supporting devices and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces.



## PART 2 - PRODUCTS

### 2.1 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment and ductwork to allow maximum possible headroom unless specific mounting heights are indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings, if applies, to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

### 3.2 PAINTING

- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.3 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- B. Field Welding: Comply with AWS D1.1.

### 3.4 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.

- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 23 05 00

**SECTION 23 05 29**  
**HANGERS AND SUPPORTS FOR HVAC EQUIPMENT**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following hangers and supports for HVAC system piping and equipment:
  - 1. Metal framing systems.
  - 2. Fastener systems.
  - 3. Equipment supports.

**1.2 PERFORMANCE REQUIREMENTS**

- A. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

**1.3 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Steel supports.
- B. Welding certificates.

**1.4 QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code--Steel."
  - 2. AWS D1.3, "Structural Welding Code--Sheet Steel."
  - 3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Known Acceptable Source: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

## 2.2 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated duct-support assembly made of steel channels and other components.
- B. Known Acceptable Source:
  1. B-Line Systems, Inc.; a division of Cooper Industries.
  2. Power-Strut Div.; Tyco International, Ltd.
  3. Tolco Inc.
  4. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

## 2.3 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  1. Known Acceptable Source:
    - a. Redhead.
    - b. Hilti, Inc.
    - c. ITW Ramset/Red Head.

## 2.4 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

## 2.5 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment on concrete pads.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.2 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

### 3.3 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 23 05 29

**SECTION 23 05 93**  
**TESTING, ADJUSTING, AND BALANCING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Balancing Air Systems:
    - a. Constant-volume air systems.

**1.2 DEFINITIONS**

- A. AABC: Associated Air Balance Council.
- B. COTR: Contracting Officer's Technical Representative
- C. NEBB: National Environmental Balancing Bureau.
- D. TAB: Testing, adjusting, and balancing.
- E. TABB: Testing, Adjusting, and Balancing Bureau.
- F. TAB Specialist: An entity engaged to perform TAB Work.

**1.3 SUBMITTALS**

- A. Qualification Data: Within 25 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Certified TAB reports.
- C. Sample report forms.
- D. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.
  - 4. Dates of use.
  - 5. Dates of calibration.

**1.4 QUALITY ASSURANCE**

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.
  - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
  - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.
- B. Certify TAB field data reports and perform the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard TAB contractor's forms approved by COTR and Commissioning Authority.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

#### 1.5 PROJECT CONDITIONS

- A. Full FAA Occupancy: FAA will occupy the site and existing building during entire TAB period. Cooperate with FAA during TAB operations to minimize conflicts with FAA's operations.

#### 1.6 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

### PART 2 - PRODUCTS (Not Applicable)

### PART 3 - EXECUTION (As applies)

#### 3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.

- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan curves.
  - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- I. Examine operating safety interlocks and controls on HVAC equipment.
- J. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.2 PREPARATION

- A. Complete system-readiness checks and prepare reports. Verify the following:
  - 1. Permanent electrical-power wiring is complete.
  - 2. Automatic temperature-control systems are operational.
  - 3. Equipment and duct access doors are securely closed.
  - 4. Balance dampers are open.
  - 5. Windows and doors can be closed so indicated conditions for system operations can be met.

### 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" ASHRAE 111 NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
  - 1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
  - 1. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 33 00 "Air Duct Accessories."



2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 00 "HVAC Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

### 3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.

### K. PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- L. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  1. Measure total airflow.
    - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
  2. Measure fan static pressures as follows to determine actual static pressure:
    - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    - b. Measure static pressure directly at the fan outlet or through the flexible connection.

- c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
  - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
    - a. Report the cleanliness status of filters and the time static pressures are measured.
  - 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
  - 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
  - 6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- M. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
  - 1. Measure airflow of submain and branch ducts.
    - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
  - 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
  - 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- N. Measure air outlets and inlets without making adjustments.
  - 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- O. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
  - 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
  - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

### 3.5 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

### 3.6 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

### 3.7 TOLERANCES

A. Set HVAC system's air flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 10 percent or minus 10 percent.
2. Air Outlets and Inlets: Plus 10 percent or minus 5 percent.

### 3.8 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

### 3.9 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. COTR's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
  - a. Indicated versus final performance.
  - b. Notable characteristics of systems.
  - c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
  - a. Settings for outdoor-, return-, and exhaust-air dampers.
  - b. Conditions of filters.
  - c. Cooling coil, wet- and dry-bulb conditions.
  - d. Face and bypass damper settings at coils.
  - e. Fan drive settings including settings and percentage of maximum pitch diameter.
  - f. Inlet vane settings for variable-air-volume systems.
  - g. Settings for supply-air, static-pressure controller.
  - h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

- a. Unit identification.
  - b. Location.
  - c. Make and type.
  - d. Model number and unit size.
  - e. Manufacturer's serial number.
  - f. Unit arrangement and class.
  - g. Discharge arrangement.
  - h. Sheave make, size in inches, and bore.
  - i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
  - j. Number, make, and size of belts.
  - k. Number, type, and size of filters.
2. Motor Data:
- a. Motor make, and frame type and size.
  - b. Horsepower and rpm.
  - c. Volts, phase, and hertz.
  - d. Full-load amperage and service factor.
  - e. Sheave make, size in inches, and bore.
  - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
3. Test Data (Indicated and Actual Values):
- a. Total air flow rate in cfm.
  - b. Total system static pressure in inches wg.
  - c. Fan rpm.
  - d. Discharge static pressure in inches wg.
  - e. Filter static-pressure differential in inches wg.
  - f. Outdoor airflow in cfm.
  - g. Return airflow in cfm.
  - h. Outdoor-air damper position.
  - i. Return-air damper position.
- F. Electric-Coil Test Reports: For electric unit heaters include the following:
1. Unit Data:
- a. System identification.
  - b. Location.
  - c. Coil identification.
  - d. Capacity in Btu/h.
  - e. Number of stages.
  - f. Connected volts, phase, and hertz.
  - g. Rated amperage.
  - h. Air flow rate in cfm.
  - i. Face area in sq. ft..
  - j. Minimum face velocity in fpm.
2. Test Data (Indicated and Actual Values):

- a. Heat output in Btu/h.
- b. Air flow rate in cfm.
- c. Air velocity in fpm.
- d. Entering-air temperature in deg F.
- e. Leaving-air temperature in deg F.
- f. Voltage at each connection.
- g. Amperage for each phase.

G. Fan Test Reports: For supply, and exhaust fans, include the following:

1. Fan Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and size.
- e. Manufacturer's serial number.
- f. Arrangement and class.
- g. Sheave make, size in inches, and bore.
- h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

- a. Motor make, and frame type and size.
- b. Horsepower and rpm.
- c. Volts, phase, and hertz.
- d. Full-load amperage and service factor.
- e. Sheave make, size in inches, and bore.
- f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
- g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

- a. Total airflow rate in cfm.
- b. Total system static pressure in inches wg.
- c. Fan rpm.
- d. Discharge static pressure in inches wg.
- e. Suction static pressure in inches wg.

H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

- a. System and air-handling-unit number.
- b. Location and zone.
- c. Traverse air temperature in deg F.
- d. Duct static pressure in inches wg.
- e. Duct size in inches.
- f. Duct area in sq. ft..

- g. Indicated air flow rate in cfm.
- h. Indicated velocity in fpm.
- i. Actual air flow rate in cfm.
- j. Actual average velocity in fpm.
- k. Barometric pressure in psig.
- l.

I. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

END OF SECTION 23 05 93

**SECTION 23 07 00  
HVAC INSULATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Insulation Materials:
  - a. Cellular glass.
2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Lagging adhesives.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied jackets.
9. Tapes.
10. Securements.
11. Corner angles.

**1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Qualification Data: For qualified Installer.
- C. Field quality-control reports.

**1.3 QUALITY ASSURANCE**

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per 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 and inspecting agency.
  1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.



2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

#### 1.5 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

### PART 2 - PRODUCTS

#### 2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cell-U-Foam Corporation; Ultra-CUF.
    - b. Pittsburgh Corning Corporation; Foamglas Super K.
  2. Block Insulation: ASTM C 552, Type I.
  3. Special-Shaped Insulation: ASTM C 552, Type III.
  4. Board Insulation: ASTM C 552, Type IV.
  5. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

- D. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type II with factory-applied vinyl jacket. III with factory-applied FSK jacket. or III with factory-applied FSP jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. CertainTeed Corp.; Duct Wrap.
    - b. Johns Manville; Microlite.
    - c. Knauf Insulation; Duct Wrap.
    - d. Owens Corning; All-Service Duct Wrap.
- E. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ or with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied ASJ or with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. CertainTeed Corp.; Commercial Board.
    - b. Johns Manville; 800 Series Spin-Glas.
    - c. Knauf Insulation; Insulation Board.
    - d. Owens Corning; Fiberglas 700 Series.

## 2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Insulco, Division of MFS, Inc.; Triple I.
    - b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Insulco, Division of MFS, Inc.; SmoothKote.
    - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
    - c. Rock Wool Manufacturing Company; Delta One Shot.

## 2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products, Division of ITW; CP-97.
    - b. Foster Products Corporation, H. B. Fuller Company; 81-27/81-93.
    - c. Marathon Industries, Inc.; 290.
    - d. Mon-Eco Industries, Inc.; 22-30.
    - e. Vimasco Corporation; 760.
  - 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Cellular-Glass Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products, Division of ITW; CP-96.
    - b. Foster Products Corporation, H. B. Fuller Company; 81-33.
  - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
  - 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Childers Products, Division of ITW; CP-82.
  - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
  - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
  1. For indoor applications, use mastics that have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products, Division of ITW; CP-35.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
    - c. ITW TACC, Division of Illinois Tool Works; CB-50.
  2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
  5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products, Division of ITW; Encacel.
    - b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
    - c. Marathon Industries, Inc.; 570.
  2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
  3. Service Temperature Range: Minus 50 to plus 220 deg F.
  4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
  5. Color: White.
- D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Childers Products, Division of ITW; CP-10.
  - b. Foster Products Corporation, H. B. Fuller Company; 35-00.
  - c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

## 2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
  1. For indoor applications, use lagging adhesives that have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products, Division of ITW; CP-52.
    - b. Foster Products Corporation, H. B. Fuller Company; 81-42.
  3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
  4. Service Temperature Range: Minus 50 to plus 180 deg F.
  5. Color: White.

## 2.6 SEALANTS

- A. Joint Sealants:
  1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products, Division of ITW; CP-76.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-45.
    - c. Pittsburgh Corning Corporation; Pittseal 444.
  2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Permanently flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 100 to plus 300 deg F.
  5. Color: White or gray.

6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Childers Products, Division of ITW; CP-76-8.
  - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Childers Products, Division of ITW; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and

with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

- a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

## 2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
  1. Adhesive: As recommended by jacket material manufacturer.
  2. Color: Color-code jackets based on system. Color as selected by COTR.
  3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
  4. Factory-fabricated tank heads and tank side panels.
- C. Metal Jacket:
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products, Division of ITW; Metal Jacketing Systems.
    - b. PABCO Metals Corporation; Surefit.
    - c. RPR Products, Inc.; Insul-Mate.
  2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
    - a. Sheet and roll stock ready for shop or field sizing or Factory cut and rolled to size.
    - b. Finish and thickness are indicated in field-applied jacket schedules.
    - c. Moisture Barrier for Indoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper or 2.5-mil- thick Polysurlyn.
    - d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper or 2.5-mil- thick Polysurlyn.
  3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.
    - a. Material, finish, and thickness are indicated in field-applied jacket schedules.
    - b. Factory-Fabricated Fitting Covers:

- 1) Same material, finish, and thickness as jacket.
- 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
- 3) Tee covers.
- 4) Flange and union covers.
- 5) End caps.
- 6) Beveled collars.
- 7) Valve covers.
- 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Polyguard; Alumaguard 60.

## 2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
  - b. Compac Corp.; 104 and 105.
  - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
  - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.



- b. Compac Corp.; 110 and 111.
  - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
  - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
- 2. Width: 3 inches.
  - 3. Thickness: 6.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
    - b. Compac Corp.; 130.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
    - d. Venture Tape; 1506 CW NS.
  - 2. Width: 2 inches.
  - 3. Thickness: 6 mils.
  - 4. Adhesion: 64 ounces force/inch in width.
  - 5. Elongation: 500 percent.
  - 6. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    - b. Compac Corp.; 120.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
    - d. Venture Tape; 3520 CW.
    - e.
  - 2. Width: 2 inches.
  - 3. Thickness: 3.7 mils.
  - 4. Adhesion: 100 ounces force/inch in width.
  - 5. Elongation: 5 percent.
  - 6. Tensile Strength: 34 lbf/inch in width.
- E. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Dow Chemical Company (The); Saran 560 Vapor Retarder Tape.
2. Width: 3 inches.
3. Film Thickness: 6 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

## 2.10 SECUREMENTS

### A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Childers Products; Bands.
  - b. PABCO Metals Corporation; Bands.
  - c. RPR Products, Inc.; Bands.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

### B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) AGM Industries, Inc.; CWP-1.
    - 2) GEMCO; CD.
    - 3) Midwest Fasteners, Inc.; CD.
    - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- 1) AGM Industries, Inc.; CWP-1.
  - 2) GEMCO; Cupped Head Weld Pin.
  - 3) Midwest Fasteners, Inc.; Cupped Head.
  - 4) Nelson Stud Welding; CHP.
3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) AGM Industries, Inc.; RC-150.
    - 2) GEMCO; R-150.
    - 3) Midwest Fasteners, Inc.; WA-150.
    - 4) Nelson Stud Welding; Speed Clips.
  - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
4. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) GEMCO.
    - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, galvanized steel.
1. Manufacturers: Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. C & F Wire.
    - b. Childers Products.
    - c. PABCO Metals Corporation.

## 2.11 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. Color-coded to match adjacent surface.

- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.
- C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or 316.

### PART 3 - EXECUTION (As applies)

#### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
  - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Surface Preparation: Clean and prepare surfaces to be insulated. Remove materials that will adversely affect insulation application.
- B. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

#### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Cleanouts.
- Q. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
  - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

- b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
- 5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  - 6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.4 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
  - 1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
  - 2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
  - 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
  - 1. Draw jacket material smooth and tight.
  - 2. Install lap or joint strips with same material as jacket.
  - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
  - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
  - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
  - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
- E. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presizes jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch- circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

### 3.5 FINISHES

- A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting Sections.
  1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by COTR. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  1. Inspect ductwork, randomly selected by COTR, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be



limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

2. Inspect field-insulated equipment, randomly selected by COTR, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
3. Inspect pipe, fittings, strainers, and valves, randomly selected by COTR, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.7 DUCT INSULATION SCHEDULE, GENERAL

#### A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply air.
2. Indoor, concealed return located in nonconditioned space.
3. Outdoor, exposed supply and return.

#### B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Factory-insulated access panels and doors.

### 3.8 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Duct Exposed:
  1. Aluminum, Corrugated : 0.032 inch thick.

END OF SECTION 23 07 00

**SECTION 23 31 13  
METAL DUCTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. Single-wall rectangular ducts and fittings.
  2. Single-wall round ducts and fittings.
  3. Sheet metal materials.
  4. Duct liner.
  5. Sealants and gaskets.
  6. Hangers and supports.

**1.2 PERFORMANCE REQUIREMENTS**

- A. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

**1.3 SUBMITTALS**

- A. Product Data: For each type of the following products:
1. Liners and adhesives.
  2. Sealants and gaskets.
  3. Seismic-restraint devices.
- B. Field quality-control reports.

**1.4 QUALITY ASSURANCE**

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

## PART 2 - PRODUCTS

### 2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 2.2 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G60.
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
  - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.3 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Known Acceptable Source: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. CertainTeed Corporation; Insulation Group.
    - b. Johns Manville.
    - c. Knauf Insulation.
    - d. Owens Corning.
      - 1) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
  2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
  3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
    - a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Natural-Fiber Duct Liner: 85 percent cotton, 10 percent borate, and 5 percent polybinding fibers, treated with a microbial growth inhibitor and complying with NFPA 90A or NFPA 90B.
1. Known Acceptable Source: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2.
    - a. Bonded Logic, Inc.
    - b. Reflectix Inc.
  3. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature when tested according to ASTM C 518.
  4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to ASTM E 84; certified by an NRTL.
  5. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
    - a. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel ; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- D. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
  2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
  3. Butt transverse joints without gaps, and coat joint with adhesive.
  4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
  5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
  6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
  7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
  8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
    - a. Fan discharges.
    - b. Intervals of lined duct preceding unlined duct.
    - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
  9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
    - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
  10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

## 2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
  2. Tape Width: 3 inches .
  3. Sealant: Modified styrene acrylic.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  7. Service: Indoor and outdoor.
  8. Service Temperature: Minus 40 to plus 200 deg F.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
  10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
  2. Solids Content: Minimum 65 percent.
  3. Shore A Hardness: Minimum 20.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. VOC: Maximum 75 g/L (less water).
  7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  8. Service: Indoor or outdoor.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
  2. Type: S.
  3. Grade: NS.
  4. Class: 25.
  5. Use: O.
  6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## 2.5 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports:
  1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

## PART 3 - EXECUTION

### 3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.



- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- J. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers.
- K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

### 3.2 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  1. Where practical, install concrete inserts before placing concrete.
  2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
  5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.

- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.4 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 23 33 00 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.5 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
- B. Supply Ducts:
  - 1. Ducts Connected to Constant-Volume Air Conditioning Units :
    - a. Pressure Class: Positive 2-inch wg.
    - b. Minimum SMACNA Seal Class: B.
- C. Return Ducts:
  - 1. Ducts Connected to Air Conditioning Units :
    - a. Pressure Class: Positive or negative **2-inch wg**
    - b. Minimum SMACNA Seal Class: B.
- D. Intermediate Reinforcement:
  - 1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.
- E. Liner:
  - 1. Supply Air Ducts: Fibrous glass, Type I, 1 ½ inch thick.
  - 2. Return Air Ducts: Natural fiber, 1 1/2 inch thick.
- F. Elbow Configuration:
  - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
    - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

- b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
- c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

G. Branch Configuration:

- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."
  - a. Rectangular Main to Rectangular Branch: 45-degree entry.
  - b. Rectangular Main to Round Branch: 45-degree entry.

END OF SECTION 23 31 13

**SECTION 23 33 00**  
**AIR DUCT ACCESSORIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Manual volume dampers.
  - 2. Flange connectors.
  - 3. Flexible connectors.
  - 4. Duct accessory hardware.

**1.2 SUBMITTALS**

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

**1.3 QUALITY ASSURANCE**

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G60.
  - 2. Exposed-Surface Finish: Mill phosphatized.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.2 MANUAL VOLUME DAMPERS

### A. Standard, Steel, Manual Volume Dampers:

1. Known Acceptable Source: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Air Balance Inc.; a division of Mestek, Inc.
  - b. American Warming and Ventilating; a division of Mestek, Inc.
  - c. Flexmaster U.S.A., Inc.
  - d. McGill AirFlow LLC.
  - e. METALAIRE, Inc.
  - f. Nailor Industries Inc.
  - g. Pottorff; a division of PCI Industries, Inc.
  - h. Ruskin Company.
  - i. Trox USA Inc.
  - j. Vent Products Company, Inc.
2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames:
  - a. Hat-shaped, galvanized steel channels, 0.064-inch minimum thickness.
  - b. Mitered and welded corners.
  - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
  - a. Multiple or single blade.
  - b. Parallel- or opposed-blade design.
  - c. Stiffen damper blades for stability.
  - d. Galvanized steel, 0.064 inch thick.
6. Blade Axles: Galvanized steel.
7. Tie Bars and Brackets: Galvanized steel.

## 2.3 FLANGE CONNECTORS

### A. Known Acceptable Source: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

- B. Description: Factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

## 2.4 TURNING VANES

- A. Known Acceptable Source: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Ductmate Industries, Inc.
  - 2. Duro Dyne Inc.
  - 3. METALAIRE, Inc.
  - 4. SEMCO Incorporated.
  - 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
  - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall.
- E. Vane Construction: Single wall for ducts up to [**48 inches**] <Insert dimension> wide and double wall for larger dimensions.

## 2.5 FLEXIBLE CONNECTORS

- A. Known Acceptable Source: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Ductmate Industries, Inc.
  - 2. Duro Dyne Inc.
  - 3. Ventfabrics, Inc.
  - 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.

- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
  - 1. Minimum Weight: 24 oz./sq. yd..
  - 2. Minimum Tensile Strength: 500 lbf/inch in the warp and 440 lbf/inch in the filling.
  - 3. Service Temperature: Minus 50 to plus 250 deg F.
- F. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
  - 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
  - 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  - 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
  - 7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

## 2.6 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts.

- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
  - 1. Install steel volume dampers in steel ducts.
  - 2. Install aluminum volume dampers in aluminum ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install flexible connectors to connect ducts to equipment.
- G. Install duct test holes where required for testing and balancing purposes.

### 3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Operate dampers to verify full range of movement.
  - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
  - 3. Inspect turning vanes for proper and secure installation.

END OF SECTION 23 33 00



**SECTION 23 73 13**  
**PACKAGE AIR CONDITIONING (AC) UNITS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Constant air volume, single zone Air conditioning (AC) units.

**1.2 PERFORMANCE REQUIREMENTS**

- A.** The units shall be dedicated horizontal airflow. The operating range shall be between 115°F and 0°F in cooling as standard from the factory for all units. Cooling performance shall be rated in accordance with ARI testing procedures. All units shall be factory assembled, internally wired, fully charged with R-410A, and 100 percent run tested to check cooling operation, fan and blower rotation and control sequence, before leaving the factory. Wiring internal to the unit shall be colored and numbered for simplified identification. Wiring internal to the unit shall be colored and numbered for simplified identification.

**1.3 SUBMITTALS**

**A. Product Data:** For each air conditioning unit indicated.

1. Unit dimensions and weight.
2. Cabinet material, metal thickness, finishes, insulation, and accessories.
3. Fans:
  - a. Certified fan-performance curves with system operating conditions indicated.
  - b. Certified fan-sound power ratings.
  - c. Fan construction and accessories.
  - d. Motor ratings, electrical characteristics, and motor accessories.
4. Certified coil-performance ratings with system operating conditions indicated.
5. Filters with performance characteristics.

**B. Operation and Maintenance Data.**

**1.4 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories:** Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.
- C. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.
- D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- E. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."

## 1.5 COORDINATION

- A. Coordinate sizes and locations of s bases with actual equipment provided.
- B. Coordinate sizes and locations of structural-steel support members, if any, with actual equipment provided.

## 1.6 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Gaskets: One set(s) for each access door.
  - 2. Fan Belts: One set(s) for each air-handling unit fan.
  - 3. Filters: One set per unit.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Known Acceptable Source: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
  - 1. Trane
  - 2. Carrier Corporation.
  - 3. YORK International Corporation.

### 2.2 UNIT CASINGS

- A. Unit casing shall be constructed of zinc coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish. Unit's surface shall be tested 672 hours in a salt spray test in compliance with ASTM B117. Cabinet construction shall allow for all

maintenance on one side of the unit. In order to ensure a water and air tight seal, service panels shall have lifting handles and no more than three screws to remove. All exposed vertical panels and top covers in the indoor air section shall be insulated with a 1/2-inch, 1-pound density foil-faced, fire-resistant, permanent, odorless, glass fiber material. The top cover shall be one piece or, where seams exist, double hemmed and gasket sealed to prevent water leakage.

B. Inspection and Access Panels and Access Doors:

1. Panel and Door Fabrication: Formed and reinforced, single- or double-wall and insulated panels of same materials and thicknesses as casing.
2. Inspection and Access Panels:
  - a. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
  - b. Gasket: Neoprene, applied around entire perimeters of panel frames.
  - c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.
3. Access Doors:
  - a. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
  - b. Gasket: Neoprene, applied around entire perimeters of panel frames.
  - c. Size: At least 18 inches wide by full height of unit casing up to a maximum height of 72 inches.

## 2.3 COMPRESSORS

- A. All units shall have direct-drive, hermetic, scroll type compressors with centrifugal type oil pumps.
- B. Motor shall be suction gas cooled and shall have a voltage utilization range of plus or minus 10 percent of name plate voltage.
- C. All models shall have crankcase heaters, phase monitors and low and high pressure control as standard.

## 2.4 EVAPORATOR AND CONDENSER COILS

- A. Micro channel coils will be burst tested by the manufacturer. Internally finned, 5/16" copper tubes mechanically bonded to a configured aluminum plate fin shall be standard on high efficiency models.
- B. Micro channel condenser coils shall be standard on all units. Coils shall be leak tested to ensure the pressure integrity. The evaporator coil and condenser coil shall be leak tested to 225 psig and pressure tested to 450 psig.

- C. Sloped condensate drain pans shall be standard.

## 2.5 INDOOR/OUTDOOR FANS

- A. Units above shall have indoor belt driven, FC centrifugal fans with adjustable motor sheaves. Units with standard motors shall have an adjustable idler-arm assembly for quick-adjustment of fan belts and motor sheaves. All motors shall meet the U.S. Energy Policy Act (EPACT).
- B. The outdoor fans shall be direct drive, statically and dynamically balanced, draw through is a vertical discharge position. The fan motors shall be permanently lubricated and have built in thermal overload protection.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for condensate drainage piping systems and electrical services to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Equipment Mounting: Install air conditioning units on steel frame bases per detail on drawings.
- B. Arrange installation of units to provide access space for service and maintenance.
- C. Do not operate fan system until filters (temporary or permanent) are in place.

### 3.3 CONNECTIONS

- A. Comply with requirements for piping specified in other Division 23 Sections. Drawings indicate general arrangement of duct, piping, fittings, and specialties.
- B. Connect condensate drain pans using 1", ASTM B 88, Type K copper tubing unless noted otherwise. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.
- C. Connect duct to air-handling units with flexible connections. Comply with requirements in Section 23 33 00 "Air Duct Accessories."

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
  - 1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Air conditioning units or components will be considered defective if unit or components do not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Verify that shipping, blocking, and bracing are removed.
  - 3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
  - 4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
  - 5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
  - 6. Comb coil fins for parallel orientation.
  - 7. Verify that proper thermal-overload protection is installed for electric coils.
  - 8. Install new, clean filters.

### 3.6 ADJUSTING

- A. Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing" for air-handling system testing, adjusting, and balancing.

### 3.7 CLEANING

- A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train FAA's maintenance personnel to adjust, operate, and maintain air-handling units.

END OF SECTION 23 73 13

**SECTION 26 05 00**  
**COMMON WORK RESULTS FOR ELECTRICAL**

**PART 1 – GENERAL**

**1.1 SUMMARY**

- A. General: The general electrical requirements in this section are applicable to both Parsons' Furnished Equipment and non-Parsons' furnished equipment. Materials and equipment shall comply with all requirements of the contract documents. Materials furnished by the Subcontractor shall be new, the standard products of manufacturers regularly engaged in the production of such materials, and of the manufacturer's latest designs that comply with the specification requirements. If material and equipment requirements conflict, the order of precedence for selection shall be as follows:
- a. The contract specifications, the contract drawings.
  - b. Federal Aviation Administration specifications and standards
  - c. Contract drawings.
  - d. NFPA-70 National Electrical Code.
  - e. UL Standards and NEMA Standards.
  - f. IEEE Standards.
  - g. Federal Specifications.
  - h. Military Specifications.

Wherever standards have been established by Underwriters Laboratories, Inc., the material shall bear the UL label.

**1.2 ELECTRICAL CHARACTERISTICS**

- A. Provide the following electrical equipment and systems:
1. Equipment, wiring devices and electrical connections required for installation of electrical equipment.
  2. Raceways and wiring for power and controls, including underground ductbanks.
  3. Service entrance equipment.
  4. Grounding systems.
  5. Concrete equipment bases.
  6. Cutting and patching for electrical construction.
  7. Lightning protection system.
  8. Seismic bracing.
- B. Spacing Requirements:
1. Electrical equipment sizes indicated on the drawings are generally based on specified manufacturer. Verify that the equipment proposed will fit in the space indicated on the drawings. Coordinate building dimensions with architectural and structural drawings. Equipment furnished and installed under other Sections of this Specification shall be coordinated with the requirements of this Section. Maintain clearances required by NFPA 70 around electrical equipment. Establish the exact location of electrical equipment based on the actual field verified dimensions of equipment furnished.

- C. For Official Use Only Departure from Dimensions Shown:
  - 1. Minor departures from exact dimensions shown in electrical plans may be permitted when required to avoid conflict or unnecessary difficulty in placement of a dimensioned item, provided all contract requirements are met. The Subcontractor shall promptly obtain written approval from the Resident Engineer prior to undertaking any such departures and shall provide appropriate documentation of the departure.

### 1.3 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Samples: When the adequacy, quality and safety of a material will be better demonstrated and it will expedite approval, provide single samples of items proposed for use. Conform to the procedures specified. Submit samples of color, lettering style, and other graphic representation required for each identification product for the project.

### 1.4 QUALITY ASSURANCE

- A. Comply with NFPA 70, FAA-STD-019f, and FAA-C-1217g for components and installation. In case of conflict between provisions of codes, laws and ordinances, the more stringent requirement shall apply.
- B. Listing and Labeling:
  - 1. Provide products specified in the Section that are listed and labeled. The terms "listed and labeled" as defined in the National Electrical Code, Article 100.
- C. Project Record Documents
  - 1. Maintain at the job site a separate set of white prints of the contract documents for the purpose of recording the system and dimension changes of those portions of work in which actual construction is at variance with the contract documents. The Subcontractor shall record changes for both Parsons' Provided Equipment and Subcontractor provided equipment. Upon acceptance of the project, submit documents to the Resident Engineer, with verification of data accuracy. Mark the drawings with colored pencil. Prepare the drawings as the work progresses. Upon completion of work submit drawings clearly indicating the following:
    - a. Locations of devices, raceways, equipment and other pertinent items. Schematic and interconnection wiring diagrams of the completed power and control system incorporating the data derived from the equipment shop drawings and the cable and raceway schedule. The drawings shall be detailed to wire and terminal block numbers, conductor color coding, device designations locations and reflect identifications established at the site.
    - b. Cable and raceway schedule for cables and raceways actually installed; include the type, size, origin, destination, and approximate length for each cable and raceway.



## 1.5 DELIVERY, STORAGE AND HANDLING

- A. Subcontractor provided equipment shall be protected from damage and stored in a dry location from the time of site delivery. Conduct routine inspections of stored equipment to check equipment condition. Follow the Manufacturer's directions for the delivery, storage, and handling of equipment and materials. Tightly cover equipment and materials and protect from dirt, water, chemical or mechanical injury and theft. Damaged equipment and material will not be acceptable. Upon installation, protect the materials until work is completed and accepted by the Contractor

## 1.6 SEQUENCING AND SCHEDULING

- A. Coordinate electrical equipment installation with other building components.
  - 1. Coordinate electrical equipment installation with other building components.
  - 2. Coordinate installing of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
  - 3. Arrange for chases, slots, and openings in building structure during progress of construction to allow for electrical installations.
  - 4. Sequence, coordinate, and integrate installing of electrical materials and equipment for efficient flow of the work. Coordinate installing large equipment requiring positioning prior to closing in the building.
  - 5. Coordinate connecting the electrical service to components furnished under other Sections.
  - 6. Coordinate connecting electrical systems with exterior underground and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
  - 7. Coordinate installing of electrical identification after completion of finishing where identification is applied to field-finished surfaces.

## PART 2 - PRODUCTS

### 2.1 SUPPORTING DEVICES

- A. Channel and angle supports, raceway supports, sleeves and fasteners shall be as specified in Section 26 05 29, "Hangers and Supports for Electrical Systems."

### 2.2 CONCRETE EQUIPMENT BASES

- A. Forms and reinforcing materials shall be as specified in Section 03 30 00, "Cast-in-Place Concrete."

### 2.3 ELECTRICAL IDENTIFICATION

- A. Provide electrical identification as specified in Section 26 05 53, "Identification for Electrical Systems." Manufacturer's standard products to use colors prescribed by ANSI A13.1 and NFPA 70.

## PART 3 – EXECUTION

### 3.1 EQUIPMENT INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. All materials and equipment shall be installed in accordance with the contract drawings. Where manufacturer's recommended installation methods conflict with the contract requirements, difference shall be resolved by the Resident Engineer. The installation shall be accomplished by skilled workers regularly engaged in this type of work. A licensed Master Electrician shall be required for all electrical equipment installation, raceway installation, wiring, and electrical tests. Electrical Apprentices may be used under the direct supervision of a Master Electrician.

### 3.2 EXCAVATION FOR ELECTRICAL WORK

A. All excavations shall comply with civil specification requirements.

### 3.3 INSTALLATION

A. The rules, regulations, and reference documents indicated shall be considered as minimum requirements and shall not relieve the Subcontractor from furnishing and installing higher grades of materials and workmanship than are specified or when required by the contract drawings. Equipment shall be installed in a manner to provide proper working space, access, and space for removal of the equipment to suit intended application.

B. Contract Drawings:

1. Where the drawings schematically indicate the work, diagrammatically or otherwise, furnish and install equipment, material and labor for a complete and proper installation. Ensure that electrical and communications work is coordinated and compatible with Architectural, Mechanical, Structural, and Civil work.

C. Fastening:

1. Unless otherwise indicated, securely fasten electrical items and their supporting hardware to the building structure in accordance with Section 26 05 29, "Hangers and Supports for Electrical Systems."

D. Concrete Pads:

1. Install concrete pads and bases according to requirements of Section 03 30 00, "Cast-in-Place Concrete."

E. Identification Devices:

1. Install identification devices where required in accordance with the requirements of Section 26 05 53, "Identification for Electrical Systems."

### 3.4 DEMOLITION

- A. Protect existing electrical equipment and installations when performing new work. If damaged or disturbed in the course of the work, remove damaged portions and install new products of equal capacity, quality, and functionality. Remove demolished material from the project site. Remove, store, clean, re-install, reconnect, and make operational components indicated for relocation.
  
- B. Accessible Work:
  - 1. Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
  
- C. Abandoned Work:
  - 1. Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 feet below the surface of adjacent construction. Cap raceways and patch surface to match existing finish. All wire not removed shall have the Resident Engineer's written approval.

### 3.5 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for electrical installations. Perform cutting by skilled mechanics of the trades involved. Repair disturbed surfaces to match adjacent undisturbed surfaces.

**END OF SECTION**

THIS PAGE INTENTIONALLY BLANK

**SECTION 26 05 00.10**  
**BASIC ELECTRICAL MATERIALS AND METHODS**

PART-1 GENERAL

1.1 WORK INCLUDED

1.1.1 General

- A. Furnish material, equipment, labor, and incidentals necessary for complete and operational systems as specified herein.
- B. This section concerns all other sections in Division 26 and shall be considered a part of each of those sections as if written in their entirety.
- C. The general electrical requirements in this section are applicable to both GFE and non-GFE equipment.
- D. Replacement and spare parts shall be provided as indicated in other sections of Division 26.

1.2 REFERENCE STANDARDS

1.2.1 General:

Comply with the standards in effect as of the date of the Contract Documents as applicable to the extent specified in this Division. The rules, regulations and reference specifications enumerated in these specifications shall be considered as minimum requirements. Adherence to other standards shall not relieve the subcontractor from furnishing and installing higher grades of materials and workmanship when so required by this specification. Adherence to this specification shall not relieve the Subcontractor from furnishing and installing higher grades of materials and workmanship when so required by the Contract Drawings or special contracts provisions. Electrical work shall be executed in accordance with local, state, and national codes, ordinances, and regulations that have jurisdiction authority over the work. If Conflicts occur between FAA documents and any other document, the FAA requirements shall be used.

1.2.1.1 American Standard for Testing and Materials (ASTM)

D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort

1.2.1.2 Federal Aviation Administration (FAA)

FAA-STD-019f Lightning and Surge Protection, Grounding, Bonding, and Shielding Requirements for Facilities and Electronic Equipment

FAA-C-1217G Electrical Work, Interior

FAA-C-1391d Installation, Termination, Splicing, and Transient/Surge Protection of Underground Electrical Distribution System Power Cables

- 1.2.1.3 Institute of Electrical and Electronic Engineers (IEEE)
  - 519 Recommended Practices and Requirements for Harmonic Control and Electrical Power Systems
- 1.2.1.4 National Electrical Manufacturers Association (NEMA)
  - WC70-00 Non-Shielded Power Cable 2000V or Less
  - WC26-00 Binational Wire and Cable Packaging Standard
- 1.2.1.5 National Fire Protection Association (NFPA)
  - 70 National Electrical Code (NEC), latest edition
- 1.2.1.6 National Electrical Contractors Association (NECA)
  - 1-2000 Standard of Installation
- 1.2.1.7 Occupational Safety and Health Administration (OSHA)
  - 29CFR1907 Description and Requirements for a Nationally Recognized Testing Laboratory (NRTL)
- 1.2.1.8 Underwriters Laboratories (UL)
  - 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors
- 1.2.1.9 Federal Specifications:
  - J-C-30 Cable and Wire, Electrical (Power, Fixed Installation)
  - L-T-1512 Tape, Wrapping, Pressure-Sensitive; Adhesive Tape 1512
  - L-P-390 Plastic Molding and Extrusion Material, Polyethylene and Co-polymers Low, Medium Density
  - W-C-582 Raceway, Metal and Fittings: Surface
  - W-C-586 Raceway Outlets, Boxes, Bodies, and Entrance Caps, Electrical; Cast Metal – For Shore Use
  - W-F-406 Fittings for Cable, Power, Electrical and Raceway, Metal Flexible
  - W-F-408 Fittings for Raceway, Metal, Rigid (Thick-Wall and Thin Wall (EMT-Type))
  - W-S-610 Splice, Conductor
  - HH-I-510 Insulation Tape, Electrical, Friction
  - HH-I-595 Insulation Tape, Electrical, Pressure-Sensitive Adhesive, Plastic, or Low Temperature Application
  - W-C-563 Raceway, Metal, Rigid; and Bends and Elbows, Electrical Raceway: Thin Walled Type (EMT)
  - W-C-566 Raceway, Metal, Flexible
  - W-C-581 Raceway, Metal, Rigid and Intermediate; Coupling, Elbow, Nipple, Electrical Raceway: Zinc-Coated

### 1.3 JOB CONDITIONS

- A. Obtain and pay for all permits, licenses, and inspection completion as required by law for the completion of the work. Certificates of approval shall be secured, paid for and delivered to the Contractor before receiving the acceptance of the work.
- B. The location of materials, equipment, devices, and appliances indicated are approximate and subject to revisions at the time of installation. The Contract Drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.
- C. Should project conditions require any rearrangement of work, or if equipment or accessories can be installed to a better advantage than the general arrangement of work on the plans, the Subcontractor may, before proceeding with the work, prepare and submit plans of the proposed rearrangement to the FAA.
- D. Equipment Size: Electrical equipment size indicated on the Contract Drawings is based on a particular manufacturer. It is the responsibility of the Subcontractor to verify that the equipment he proposes to furnish will fit in the space indicated on the Drawings.
- E. Equipment Coordination: Equipment furnished and installed under other Sections of this Specification and by the Contractor shall be coordinated with equipment furnished and installed under this section.
- F. Electrical work shall be performed under the supervision of a master Electrician who holds a valid license.
- G. Code Violations: Perform work to meet or exceed the requirements of the National Electrical Code and other applicable statutes, FAA orders, codes, and regulations of the governmental authorities having jurisdiction. Resolve any code violations discovered in the Contract Documents with the Subcontracts Administrator prior to award of the Contract.

After the award of the Contract, make any corrections or additions necessary for the compliance with applicable codes at no additional cost to the Government.

### 1.4 GUARANTEES

The work shall be guaranteed for one year from the date of final acceptance of the project and during that period the Subcontractor shall make repair at his expense any faults or imperfections that may rise due to defects of omissions in materials or workmanship.

### 1.5 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Manufacturer's data sheets: Component catalog numbers and manufacturer's data sheets, including pertinent data identifying each component by the item number and nomenclature, as specified.
- B. List of equipment and principal materials: Within 5 days after the Notice of Award (NOA) of the contract and before orders are placed or shop drawings are submitted, the Subcontractor shall submit to the FAA a list of equipment and principal materials

specified. Give names and manufacturer's catalog and model numbers and other such supplemental information as necessary for identification.

- C. Project Record Documents: Maintain at the job site a separate set of redline bond prints of the Contract Documents (specifications, drawings, change orders, addendums) for the purpose of recording the system and dimension changes of those portions of work in which actual construction is significantly at variance with the Contract Documents. The contractor shall record changes for all contractor provided equipment. Mark the Record Drawings with colored pencil. Prepare the Record Drawings as the work progresses. Upon completion of work, submit Record Drawings clearly indicating the following:
  - a. Locations of devices, raceways, equipment and other pertinent items; Indicate the depth of buried ducts and direct burial cables.
  - b. Schematic and interconnection wiring diagrams of the completed power and control system incorporating the data derived from the equipment shop drawings, and the cable and raceway schedule. The drawings shall be detailed to wire and terminal block numbers, conductor color coding, device designations, locations, and reflect identifications established at the site.
- D. Test Report: Submit a summary of the Electrical Test Report and Motor Test Report, noting deviations from requirements listed below:
  - a. Maximum plus or minus five percent variation between nominal system voltage and no load voltage;
  - b. Maximum plus or minus ten percent variation between average phase current and measured individual phase currents for panelboards.

## 1.6 QUALITY CONTROL

### 1.6.1 General:

The rules, regulations and reference specifications enumerated herein shall be considered as minimum requirements and shall not relieve the Subcontractor from furnishing and installing higher grades of material and workmanship than are specified herein or when so required by the Contract Drawings. Materials, appliances, and equipment provided shall meet the requirements of the Underwriters Laboratories, Inc. (UL), Electrical Testing Laboratories (ETL) and other standard organizations. This specification shall govern when conflicts occur between reference documents and this specification.

### 1.6.2 Electrical Subcontractor's Qualification:

Use adequate numbers of skilled workmen, trained and experienced in their crafts, and who are familiar with the specifications and methods of performing the work in this Division.

### 1.6.3 Licensed:

The electrical foreman shall be a licensed journeymen electrician.

### 1.6.4 Workmanship:

Work shall be performed in accordance with quality, commercial practices. The appearance of finished work shall be of equal importance with its operation. Material and equipment shall be installed based upon the actual dimensions and conditions at the project site.



Locations for materials or equipment requiring exact fit shall be field measured. Raceway, transformers, and motors shall be isolated to avoid unacceptable noise levels from objectionable vibrations from all systems.

#### 1.6.5 Contract Drawings:

Where the electrical drawings indicate (diagrammatically or otherwise) the work intended and the function to be performed even though some minor details are not shown, the Subcontractor shall furnish all equipment, material (other than Government Furnished Equipment), and labor to complete the installation work and accomplish all indicated functions of the electrical installation. Further, the Subcontractor shall be responsible for taking the necessary actions to ensure that all electrical work is coordinated and compatible with all other disciplines, general, NFPA 70 latest edition, and FAA Standards.

#### 1.6.6 View Other Sections:

The Subcontractor is to review other sections of this specification to determine electrical requirements for equipment furnished under those sections. Coordinate all electrical rough-ins and connections for proper function of this equipment.

#### 1.6.7 Listing and Labeling:

Provide products specified in the section that are listed and labeled:

- A. The terms "Listed and Labeled" as defined in the National Electrical Code, (latest edition) Article 100.
- B. Listing and Labeling Agency Qualifications: NRTL as defined in OSHA Regulation 1910.7.
- C. Field installed nameplates shall conform to Division 26 05 53, Identification of Electrical Systems.
- D. Nameplates on manufactured items shall be aluminum or type 304 stainless steel not less than 20 US Gauge, riveted, bolted to the manufactured item, with nameplate data engraved or punched to form a non-erasable record of the equipment data.

## PART-2 PRODUCTS

### 2.1 PRODUCTS

- A. Manufacturer's Recommendation: While installation procedures or any part thereof are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendation prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish the recommendations shall be cause of rejection of the equipment or material.
- B. Provide equipment and material of sizes, capacities, power ratings and dimensions as indicated on the Contract Drawings and in drawing schedules.
- C. All structural and miscellaneous steel used in connection with electrical work and located out-of-doors or in damp locations shall be hot dipped galvanized unless otherwise specified. Included are underground steel pull box covers and similar

electrical items. Galvanizing shall average 2.0 ounce per square foot and shall conform to ASTM A123.

- D. Approval of materials and equipment will be based on the manufacturer's printed data. The label or listing of Underwriter's Laboratories, Inc., will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this listing, the Subcontractor may submit a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures of the Underwriter's Laboratories, Inc., and that the materials and equipment comply with all Contract requirements. A manufacturer's statement indicating complete compliance with the applicable Federal Specification or Standard of the American Society for Testing and Materials, National Electrical Manufacturers Association or other Commercial Standards, will be acceptable proof of such compliance.
- E. Materials and equipment shall conform to respective publications and any other requirements specified below. The Subcontractor shall furnish all materials. Materials and equipment, to be acceptable, must comply with all contract requirements. Materials to be furnished by the Subcontractor under this specification shall be of manufacturers regularly engaged in the production of such material and of the manufacturer's latest designs that comply with the specification requirements.

## 2.2 SUPPORT FOR ELECTRICAL EQUIPMENT:

Channel and Angle Supports, Raceway Supports, Sleeves and Fasteners: As specified in Section 26 05 29.

## 2.3 MANUFACTURER'S STANDARD PRODUCTS:

Use colors prescribed by ANSI A13.1, NFPA 70.

# PART-3 EXECUTION

## 3.1 EQUIPMENT INSTALLATION REQUIREMENTS

- A. All materials and equipment shall be installed in accordance with the Contract Drawings, and with NFPA 70, FAA-C-1217G, and FAA-STD-019f.
- B. Coordinate electrical work with that of other trades so that:
  - a. Interference between electrical and other specialty trades is to be avoided.
  - b. Maintain clearances and advise other trades of clearance requirements for operation, repair, removal and testing of electrical equipment.
  - c. All electrical materials and equipment shall be kept as close as possible to ceilings, walls and columns to occupy the minimum amount of space.
  - d. Furnish and install all offsets, fittings and similar items necessary to accomplish the requirements of coordination without additional expense.

- e. Equipment required to be temporarily disconnected and relocated shall be carefully removed, stored, leaned, reinstalled, reconnected, and made operational.
- C. Where manufacturers recommended installation methods conflict with contract requirements, prior approval shall be obtained from the FAA for all deviation from contract requirement.
- D. The installation shall be accomplished by skilled workers regularly engaged in this type of work. Where required by local regulation, the workers shall be properly licensed.
- E. Install components and equipment to provide the maximum possible headroom where mounting heights or other location criteria are not indicated.
- F. Install items level, plumb, parallel, and/or perpendicular to other building systems and components, except where otherwise indicated.
- G. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- H. Maintain the waterproof integrity of raceway penetrations through the roof, exterior walls, and floors.
- I. The drawings indicate certain information pertaining to surface and subsurface obstructions that has been taken from available site drawings. Such information is not guaranteed as to accuracy of location or completeness.
- J. Equipment shall be properly anchored and supported to resist shear and overturning moments for UBC Seismic Zone 2B.

## 3.2 INSTALLATION

### 3.2.1 Contract Drawings:

Where the Contract Drawings schematically indicate the work, diagrammatically or electrically, ensure that the electrical and communications work is coordinated and compatible with Architectural, Mechanical and Structural work.

### 3.2.2 Support and Fastening:

Unless otherwise indicated, securely fasten electrical items and their supporting hardware to the building structure in accordance with Section 26 05 29.

### 3.2.3 Identification Devices

Install identification devices where required in accordance with the requirements of Section 26 05 53.

### 3.2.4 Wiring Methods:

#### 3.2.4.1 General

All wiring shall consist of insulated copper conductors installed in metallic raceways unless otherwise specified.

#### 3.2.4.2 Conductor routing:

Panelboards, surge arresters, disconnect switches, etc., shall not be used as raceway for conductor routing other than conductors that originate or terminate in these enclosures. Isolated ground conductors will be allowed to traverse these enclosures.

#### 3.2.4.3 Conductor separation

Power conductors shall be routed separately from all other conductor types. Route power conductors and other conductors in separate raceways, or use a metallic divider between the power conductors and any other conductors in the same raceway, in these enclosures. Isolated ground conductors will be allowed to traverse these enclosures

A. Power cables of less than 600 volts may be installed in the same duct.

B. Power cables of less than 600 Volts shall not be installed in the same duct with control, telephone, or signal type cables.

#### 3.2.4.4 Neutral conductor

Shared/common neutrals shall not be permitted, i.e., each overcurrent protection device shall have its own separate neutral conductor. Neutral conductor sizes shall not be less than the respective feeder or phase conductor sizes.

#### 3.2.5 Raceway Openings

All Raceway openings through floors shall be both airtight and watertight.

#### 3.2.6 Weather Protection

Seal equipment or components exposed to the weather and make watertight and rodent proof. Protect equipment outlet and Raceway openings with temporary plugs or caps at all times work is not in progress.

### 3.3 CUTTING AND PATCHING

Cut, channel, chase, and drill floors, walls, and other surfaces necessary for electrical installations. Perform cutting by skilled mechanics of the trades involved.

Repair disturbed surfaces to match adjacent undisturbed surfaces.

### 3.4 TESTING

#### 3.4.1 General:

Unless otherwise indicated, the subcontractor shall furnish all test instruments, materials and labor necessary to perform tests designated in other Sections of this Division.

### 3.4.2 Calibration:

All tests shall be performed in the presence of the FAA personnel. All instruments shall have been calibrated within a period of two years preceding testing. Calibrations shall be traceable to applicable industry recognized standards.

#### 3.4.2.1 Tests:

- A. An interim operating and performance test shall be performed for each major equipment item after installation is complete and before the item is placed in service.
- B. After mechanical systems have been completely installed and balanced, test each system for proper operation.
- C. Tests shall be conducted in the presence of the FAA under design conditions to ensure proper sequence and operation throughout the range of operation.
- D. Make adjustments as required to ensure proper functioning of the systems.
- E. Special tests on individual systems are specified under individual sections.
- F. Provide 5 days written notice to the FAA for major tests. Subcontractor shall demonstrate, to the FAA's satisfaction, proper operation of control devices by simulating actual operating conditions.
- G. Devices tested shall include, but not be limited to, flow and pressure controls, temperature controls, and system interlocks and alarms.
- H. Perform the tests specified and other tests necessary to establish the adequacy, quality, safety, completed status, and suitable operation of each system.
- I. Repair or replace equipment that does not meet test requirements and retest. Notify the FAA in writing 5 days prior to conducting tests.

### 3.4.3 Instructions:

After final tests and adjustments have been completed, fully instruct the FAA and other personnel as directed by the FAA in details of operation and maintenance of electrical equipment.

### 3.4.4 Underground Cable Test:

Test in accordance with FAA-C-1391d. Testing of GFM cable shall be performed before and after installation.

## 3.5 DELIVERY, STORAGE AND HANDLING

- A. Clean and wipe the interior of Raceway, pullboxes and panelboards before proceeding with the wiring.
- B. Do not install damaged, broken or marred material or products, replace them with new.
- C. On long-lead delivery items which are damaged in shipping or storage, field repair may be authorized instead of replacement. Repair authorization must be in writing.

### 3.6 FIELD QUALITY CONTROL

#### 3.6.1 Restoration of Finish:

All marred or damaged surfaces, except exposed metal for grounding purposes, shall be refinished to leave a smooth, uniform finish at final inspection. Paint to match existing.

#### 3.6.2 Repair of Existing Work:

Where cutting, channeling, or drilling of floors, walls, or other surfaces is necessary for the proper installation, support or anchorage of the raceway, raceways, or other electrical work, it shall be carefully done. The subcontractor shall repair with equal material by skilled workers, any damage to facilities caused by the subcontractor's workers or equipment. Prior FAA approval must be obtained for the materials, workers, time of day or night, repair method and for temporary or permanent repair purposes.

On completion, repair work shall be inspected and accepted by the FAA with the concurrence of any other affected parties such as Utility Companies and Airport Authority.

#### 3.6.3 Damage:

Where raceway and wiring to remain are inadvertently damaged or disturbed, cut out and remove portion and all damaged wiring from the source panelboard, disconnect switch or pull box to the load/destination point. Provide new wiring of equal capacity.

**END OF SECTION**

THIS PAGE INTENTIONALLY LEFT BLANK.

**SECTION 26 05 19**  
**LOW VOLTAGE CABLES**

**PART-1 GENERAL**

**1.1 SUMMARY**

This Section includes building wires and cables and associated splices, connectors, and terminations for wiring systems rated 600 volts and less.

**1.1.1 Work shall include**

1. Wire
2. Multi-Conductor Cable
3. Wire Connections and Terminations
4. Ground Wire

**1.2 REFERENCE STANDARDS**

The publications listed below form a part of this specification to the extent referenced. The publications listed below are referenced as the latest edition published as of the date of this document. The publications are referred to within the text by the basic designation only.

**1.2.1 A. National Electrical Manufacturers Association (NEMA)**

- |         |  |
|---------|--|
| WC70-00 | Non-Shielded Power Cable 2000V or Less       |
| WC26-00 | Binational Wire and Cable Packaging Standard |

**1.2.2 B. Federal Aviation Administration (FAA)**

- |              |  |
|--------------|--|
| FAA-C-1391d  | Installation, Termination, Splicing, and Transient/Surge Protection of Underground Electrical Distribution System Power Cables |
| FAA-C-1217G  | Electrical Work, Interior  |
| FAA-STD-019f | Lightning and Surge Protection, Grounding, Bonding, and Shielding Requirements for Facilities and Electronic Equipment         |

**1.2.3 C. Federal Specification (FS)**

- |          |                                       |
|----------|---------------------------------------|
| W-S-610  | Splice Connectors                     |
| QQ-W-343 | Wire, Electrical, Copper, Uninsulated |

**1.2.4 D. National Electrical Contractors Association (NECA)**

- |        |                          |
|--------|--------------------------|
| 1-2000 | Standard of Installation |
|--------|--------------------------|

**1.2.5 E. International Electrical Testing Association (NETA)**

- |     |  |
|-----|--|
| ATS | Acceptance Testing Specification for Electric Power Distribution Equipment and Systems |
|-----|--|



- 1.2.6 F. National Fire Protection Association (NFPA)  
70 National Electrical Code (NEC), latest edition
- 1.2.7 G. Occupational Safety and Health Administration (OSHA)  
29CFR1910.7 Definitions and Requirements for a Nationally Recognized Testing Laboratory (NRTL)
- 1.2.8 H. Underwriters Laboratories (UL)  
83 Thermoplastic-Insulated Wires and Cables  
486A Wire Connectors and Soldering Lugs for Use with Copper Conductors  
486C Standard for Splicing Wire Connectors
- 1.2.9 American Society for Testing and Materials (ASTM)  
B3 Standard Specification for Soft or Annealed Copper Wire  
B8 Standard Specification for Concentric-Lay Standard Copper Conductors, Hard, Medium Hard or Soft  
D753 Standard Specification for General Purpose Polychloroprene Jacket for Wire and Cable
- 1.2.10 Institute of Electrical and Electronic Engineers (IEEE)  
241 Recommended Practice for Electric Power Systems in Commercial Buildings
- 1.2.11 Insulated Cable Engineers Association (ICEA)  
S-95-658 Non-shielded 0-2kV Cables  
S-105-692 600V Single Layer Thermoset Insulated Utility Underground Distribution Cable

### 1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES

- A. Product Data: Submit product data for each product specified.
- B. Specifications: Submit manufacturer's data on electric wire, cables, conductors, connectors, and connector crimping tools where specified.
- C. Field Test Reports: Submit field test reports indicating and interpreting test results relative to compliance with the performance requirements of the testing standard.

### 1.4 QUALITY CONTROL

#### 1.4.1 NFPA compliance

Comply with NFPA 70, NEC, latest edition, for components and installation.

#### 1.4.2 Listing and Labeling

Provide products specified in this Section that are listed and labeled.

- A. The Terms "Listed and Labeled": As defined in the NEC, Article 100.

- B. Listing and Labeling Agency Qualifications: An NRTL as defined in OSHA Regulation 1910.7.

#### 1.4.3 Installer Qualifications

Cable splices shall be performed by experienced and qualified cable splicers. The workmen shall be licensed if required by the authority having jurisdiction.

### 1.5 SEQUENCING AND SCHEDULING

#### 1.5.1 Coordination

Coordinate layout and installation of cable with other installations.

- A. Revise locations and elevations from those indicated as required to suit field conditions in coordination with the WRPM.

### 1.6 DELIVERY, STORAGE, AND HANDLING

#### 1.6.1 Delivery

Deliver all wire and cable products to the Project site in accordance with NEMA WC-26 and in their original packaging. Conductors with damaged insulation shall not be permitted.

#### 1.6.2 Storage

Store wire and cable products in a clean dry space in original containers. Protect products from weather, damaging fumes, construction debris, and traffic.

#### 1.6.3 Handling

Handle wire and cable products carefully to avoid abrading, puncturing, or tearing wire and cable insulation and sheathing. Ensure that the dielectric resistance integrity of wire/cable is maintained.

## PART-2 PRODUCTS

### 2.1 GENERAL

Materials procured in this Section shall be in accordance with FAA-C-1217G, and FAA-STD-019f.

Unless otherwise indicated, wiring shall consist of 600 volt insulated, single conductor, copper conductor, installed in raceway. Conductor shall bear easily readable marking along the entire length, indicating conductor size and insulation type.

### 2.2 WIRES AND CABLES

#### 2.2.1 Rating

Provide UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3, "Applications" of this section.

#### 2.2.2 Insulation – Above Grade and Interior Use

THHN/THWN conforming to NEMA WC70. XHHW-2 conforming to NEMA WC70. Insulation for conductors shall be rated at 75 degrees C.

### 2.2.3 Insulation – Below Grade Use

Conductors in contact with the earth or routed underground in raceway shall be type UF, USE, XHHW-2, RHW-2, XLP-2, or of a multi-conductor armored construction with equivalent outer insulation.

### 2.2.4 Characteristics

- A. All wire, raceway sizes, and ampacities are based on copper conductors, 75 degrees C insulation.
- B. Conductivity shall not be less than 98 percent at 20 degrees C (68 degrees F) or resistivity greater than 1.7 microohms per centimeter.
- C. Conductors sized 12 AWG and smaller for general use shall be solid. Stranded 12 AWG and smaller conductors are permitted where required for specific equipment installations. Conductors 10 AWG and larger may be stranded. Conductors 12 AWG and smaller are permitted to be stranded in applications where vibration and flexing may be encountered and shall be installed with compression fittings at appropriate ends.
- D. All control wiring shall be stranded.

### 2.2.5 Size

- A. Minimum power conductor size shall be 12 AWG.
- B. Minimum conductor size shall be 10 AWG for 120 volt circuits where circuit length (one way) exceeds 75 feet from source, and 8 AWG for 120 volt circuits where circuit length (one way) exceeds 150 feet from source.
- C. Communication/control systems wiring size shall be in accordance with Manufacturer's requirements.
- D. Minimum control wire size shall be 14 AWG unless otherwise noted.

### 2.2.6 Color Code

Conductors smaller than 4 AWG shall be factory color coded. Color coding shall be continuous throughout the facility on each phase conductor to its point of utilization so that the conductor phase connection is readily identifiable. Verify and use the existing color coding system at the facility. If there is no standard color coding at the facility, conductors shall be color coded as follows:

#### A. AC power wiring

##### Three Phase

##### 120/208/240 Volt System

- 1) Phase A    Black
- 2) Phase B    Red
- 3) Phase C    Blue
- 4) Neutral    White

##### Single Phase

##### 120/208/240 Volt System

- 1) Phase A    Black
- 2) Phase B    Red
- 3) Neutral    White

#### B. Equipment Grounding Conductor: Green (for all systems)

#### C. Control Wiring

- a. Ungrounded conductor wiring    Violet
- b. Grounded conductor wiring    White

D. Control Cables shall be color coded in accordance with IAW NEMA WC70.

#### 2.2.7 Uninsulated Conductors

For uninsulated conductors refer to Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

#### 2.2.8 Prohibited Wire Products

The use of non-metallic sheathed cable types NM to NMC, armored-bushed cable (BX), and armor-clad cable (AC) is prohibited.

#### 2.2.9 Control Cable

Contractor-furnished control cable shall be in accordance with Section 3.1. of FAA-C-1391d, and with Rural Utilities Service 7 CFR 1755.390 (REA PE-39). This cable shall have a core consisting of 19-gauge size (AWG) solid copper conductors with thermoplastic or thermosetting insulation color-coded per telephone industry standards. The core shall be completely filled with ETPR compound. The outer sheath shall have a corrugated copper or aluminum shield applied longitudinally around core. The outside jacket shall be black polyethylene. It shall be a standard product of a major cable manufacturer, and shall be rated for outdoor, direct-earth burial use.

### 2.3 CONNECTORS AND SPLICES

#### 2.3.1 Connectors

Provide UL-listed factory-fabricated wiring connectors of size, ampacity and temperature rating, material, type and class required by NFPA and NEMA standards for application and for services indicated. Select connectors to comply with the project's installation requirements and as specified in Part 3, "Applications."

- A. For conductor sizes 10 AWG and smaller, provide 600V solderless, insulated pressure cable connectors, of the compression or indent type, or wire nut connectors.
- B. For cable sizes 8 AWG and larger provide long barrel type compression connectors.
- C. Stranded conductors may be used with wire compression connectors or a pressure washer type lug.

#### 2.3.2 Splices

Make splices in manholes or tunnels except where cable terminations are specifically indicated. Expedite splicing and terminating of cables to minimize exposure and cable deterioration.

##### 2.3.2.1 Splice Envelopes

- A. Power cables 600 volts and below: Cast or pressure epoxy resin splice envelopes or equal or taped splice using a pre-stretched or heat-shrinkable tubing covering. Known acceptable source for all direct earth burial cable: 3M Co. or approved equal.
- B. Control and telephone cables: Re-enterable filled splice envelope, Scotch brand 3925 or approved equal.

##### 2.3.2.2 Splice Material

Provide all insulating materials for splices and connections such as glass and synthetic tapes, putties, resins, splice cases or compositions of the type approved for the particular use, location, voltage and temperature and apply and install in an approved manner, all in accordance with the manufacturer's recommendations.

#### 2.3.2.3 Insulating Tape

Provide plastic electrical insulating tape that is flame retardant and cold weather resistant. Tape to be used in areas that are subject to 30 degrees C to 105 degrees C, or where the tape will be subjected to an oil splash, shall have a minimum thickness of 8.5 mils, and shall consist of an oil-resistant vinyl backing with an oil-resistant acrylic adhesive.

#### 2.3.3 Underground Taps

Waterproof and rated for application.

### PART-3 EXECUTION

#### 3.1 EXAMINATION

Examine raceways that are to receive wires and cables for compliance with installation tolerances and other conditions. Verify that the duct or raceway is open, continuous, and clear of debris before installing cable. Do not proceed with installation until unsatisfactory conditions have been corrected.

#### 3.2 APPLICATIONS

##### 3.2.1 Grounded Conductors

In single-phase systems (120 volt two-wire and 120/240 volt three-wire), one grounded conductor (neutral) shall accompany each ungrounded phase conductor (120 volt systems) or ungrounded phase conductor pair (120/240 volt systems) powered from a circuit-interrupting device. In three-phase (Y-connected, 4-wire) systems, one grounded neutral conductor shall accompany the three related ungrounded conductors fed from a circuit interrupting device. All neutral conductors shall extend from the neutral bus in the power source. Device terminals for connection of more than one conductor shall be specifically designed for that purpose.

##### 3.2.2 Bundling

Neatly and securely bundle all conductors 10 AWG and smaller located in branch circuit panelboards. Neatly secure cable in individual circuits for all conductors larger than 10 AWG located in pull boxes. Bundle cable with wire ties.

#### 3.3 INSTALLATION

##### 3.3.1 Conductors and Cables

- A. Materials installed in this Section shall be in accordance with FAA-C-1217G, FAA-C-1391d, and FAA-STD-019f.
- B. Install wires and cables as indicated, according to manufacturer's written instructions and the NECA "Standard of Installation." Tag all conductors at their termination in accordance with Section 26 05 53, IDENTIFICATION FOR ELECTRICAL SYSTEMS.
- C. Pull conductors into raceway simultaneously when more than one is being installed in the same raceway.
  - a. Use wire pulling compound or lubricant as required. Compound used must not deteriorate the conductor or insulation and must be non-flammable.

- b. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage the cables or raceway.
- D. Cable shall be installed in a manner to prevent harmful stretching of the conductor, injury to the insulation, or damage to the outer protective covering.
- E. Install exposed cable parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.
- F. The ends of cables shall be sealed with moisture-seal tape before pulling and shall be left sealed until connections are made.

### 3.3.2 Conductor Splices

- A. Splices shall be made at outlets, junction boxes, pull boxes, manholes/handholes, or accessible raceways only. Splice 600V conductors in pull boxes only. Splices shall be made in manholes/handholes as indicated on the drawings only. All other splices within manholes/handholes shall require written approval
- B. Splices shall be made with solderless connectors conforming to FS W-S-610, UL-486A, UL-486C, and UL-486E.
- C. Wire nuts may only be used to splice conductors sized 10 AWG and smaller.
- D. Compression connectors shall be used to splice conductors 8 AWG and larger. Use proper tool to provide circumferential pressure connection.
- E. All splices, including those made with insulated wire nuts, shall be insulated with electrical tape or heat-shrink tubing to a level equal to that of the factory insulated conductors.
- F. Splicing of ungrounded conductors in panelboards is not permitted.
- G. Install splices and insulating tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
- H. Use splice and tap connectors that are compatible with conductor material.
- I. Splicing methods and material shall be of a type recommended by the manufacturer of the splicing material for the particular type of cable being spliced and shall be approved by the RE prior to installation.
- J. Conductors of different color insulation shall never be spliced together.
- K. Keep conductor splices to a minimum.
- L. A splice shall not be pulled into a duct or a raceway under any circumstances.
- M. Install waterproof taps in underground structures.

### 3.3.3 Conductor Identification

For conductors 4 AWG and larger, color code in accordance with this Section and Section 26 05 53, IDENTIFICATION FOR ELECTRICAL SYSTEMS.

- A. All line, phase, and neutral conductors shall have their source and circuit labeled.
- B. Conductor identification shall be provided at all terminations, in all junction boxes through which these conductors pass, and within each enclosure where a splice, tap, or termination is made.
- C. Terminal and conductor identification shall match at both ends of the run, as on approved shop drawings.

#### 3.3.4 Wiring at Outlets

Install with at least 12 inches of slack conductor at each outlet for connection to equipment. Identify all conductor circuit numbers at terminals and junction points.

#### 3.3.5 Connections at Outlets

Connect outlets and components to wiring and to ground as indicated on shop drawings. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

#### 3.3.6 Large Conductors

Cables/conductors sizes 250 kcmil and greater shall be installed with the use of a hydraulic cable bender where installed exposed (e.g. manholes). Cable supports shall be required for stress relief.

#### 3.3.7 Grounding

Grounding shall be installed in accordance with Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

#### 3.3.8 Shared Neutrals and Grounds

Separate neutral and ground wires shall be provided for each overcurrent protection device. Shared/common neutrals are not allowed. Install a separate neutral wire per phase for all lighting and power outlet circuits.

#### 3.3.9 Termination

Provide compression type termination lugs where mechanical lugs included with equipment do not comply with FAA STD-1217G, Paragraph 5.2.5.2.

#### 3.3.10 Phasing

The phasing of the complete electrical installation shall be connected and consistently maintained throughout the power distribution system. The phasing shall be "A, B, C, from front to back, top to bottom, or left to right, as viewed from the front of the switchboard, switchgear, or panelboard".

#### 3.3.11 Conductor Supports

The subcontractor shall provide conductor supports as required by the NEC and recommended by the cable manufacturer. Where required, route vertical conductor runs in raceway.

#### 3.3.12 Conductors and Slack

Provide all conductors and connectors necessary for a complete installation from the point of service connections to all devices shown on the drawings, in schedules, and in the specifications. Provide ample slack wire for all connections.

### 3.4 FIELD QUALITY CONTROL

#### 3.4.1 Testing, General

Cables shall be tested prior to installation and again upon completion of the installation. Testing shall also be performed prior to termination. Tests shall be performed in the presence of the FAA.

- A. Upon installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

- B. Perform each visual and mechanical inspection and electrical test stated in NETA Standard ATS, Section 7.3.1. Certify compliance with test parameters.
- C. Test wire and cable for continuity of circuitry, proper phasing, and also for short circuits.

#### 3.4.2 Insulation Resistance Tests

Feeder and Branch Circuit insulation tests shall be performed after installation, but before connection to equipment.

- A. Conductors shall test free from short circuits and grounds and have a minimum phase-to-phase and phase-to-ground insulation resistance of 50 megohms when measured with a 500-volt DC insulation resistance tester. The contractor shall submit a letter type test report to the FAA prior to final inspection of the Work. The report shall list the tests performed and results obtained.
- B. Apply the test voltage for at least one minute after motor reading has stabilized.
- C. Subcontractor shall use "FAA megger form" located at the end of this Section to record megger readings.

#### 3.4.3 Corrections

Correct malfunctioning products at site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.





**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART-1 GENERAL**

**1.1 SUMMARY**

This Section includes furnishing material, equipment and labor necessary to install a complete grounding system for the protection of life and equipment, circuits and systems. Grounding requirements specified in this Section may be supplemented by requirements in other Sections of these Specifications. Work shall include the following systems:

- A. Power System Grounding
- B. Electrical and Electronic Equipment Grounding
- C. Raceway Grounding and Bonding
- D. Multipoint Grounding

**1.2 REFERENCE STANDARDS**

Applicable only to the extent specified.

- 1.2.1 American National Standards Institute (ANSI)
  - C62.41 Recommended Practices on Surge Voltages in Low-Voltage AC Power Circuits
- 1.2.2 American Society for Testing and Materials (ASTM)
  - B3 Soft or Annealed Copper Wire
  - B8 Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, or Soft
  - B33 Tinned Soft or Annealed Copper Wire for Electrical Purposes.
- 1.2.3 Federal Aviation Administration (FAA)
  - FAA-C-1217G Electrical Work, Interior
  - FAA-STD-019f Lightning and Surge Protection, Grounding, Bonding, and Shielding Requirements for Facilities and Electronic Equipment
- 1.2.4 Institute of Electrical and Electronic Engineers (IEEE)
  - 81 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
  - 1100 Powering and grounding sensitive electronic equipment
- 1.2.5 National Fire Protection Association (NFPA)
  - 70 National Electrical Code (NEC), latest edition
  - 77 Static Electricity
  - 780 Lightning Protection Code
- 1.2.6 Occupational Safety and Health Administration (OSHA)

29CFR1910.7 Definitions and Requirements for Nationally Recognized Testing Laboratories (NRTL)

1.2.7 Underwriters Laboratories (UL)

- 96 Lightning Protection Components
- 96A Installation Requirements for Lightning Protection Systems
- 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors
- 467 Grounding and Bonding Equipment

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES

- A. Product Data: Submit product data for each product specified.
- B. Specifications: Submit manufacturer's data on grounding fittings including grounding rod, grounding bar, grounding electrodes and connectors etc. where specified.
- C. Field Test Reports: Submit field test reports indicating and interpreting test results relative to compliance with the performance requirements of the testing standard.

1.4 QUALITY CONTROL

1.4.1 NFPA compliance

Comply with NFPA 70, NEC, latest edition, for components and installation.

1.4.2 Listing and Labeling

Provide products specified in this Section that are listed and labeled.

- A. The Terms "Listed and Labeled": As defined in the NEC, Article 100.
- B. Listing and Labeling Agency Qualifications: An NRTL as defined in OSHA Regulation 1910.7.

PART-2 PRODUCTS

2.1 GROUNDING AND BONDING PRODUCTS

Materials procured in this Section shall be in accordance with FAA-C-1217G, and FAA-STD-019f. Where types, sizes, ratings and quantities indicated are in excess of requirements above, the more stringent requirements and the greater size, rating, and quantity indications shall govern.

2.2 POWER DISTRIBUTION SYSTEM GROUNDING

- A. Grounding system: The facility electrical grounding shall comply with NFPA 70. Ground Rods: Ground Rods shall be 3/4 inch diameter by 10 feet copper or copper-clad steel. Sectionalized type or exothermic butt welded rods shall be provided when deeper earth penetration is required. Ground rods shall bear the manufacturer's name, trademark and catalog number..

2.3 EQUIPMENT GROUNDING CONDUCTORS (EGC):

- A. Type: Copper conductor with green color insulation.

- B. Size: Equipment grounding conductors shall be sized the same as phase conductors per FAA-STD-019g.
- C. The equipment grounding conductor shall be routed in the same raceway as its' related phase and neutral conductors. Cord-connected equipment requiring an equipment ground shall include the equipment grounding conductor as an integral part of the power cord. Where power is supplied to electronic equipment through a cable and connector, the connector shall contain a pin to continue the equipment grounding conductor to the equipment chassis. Conduit or cable shields shall not be used as the equipment grounding conductor.
- D. Grounding terminals in all receptacles on multi-outlet assemblies shall be hardwired to an equipment grounding conductor. Strips that depend upon serrated or toothed fingers for grounding shall not be used.
- E. A separate equipment grounding conductor shall be provided for each overcurrent device and as required by the NEC.
- F. All metallic boxes shall include a grounding pigtail (#12 minimum) connected to the EGC.
- G. All feeder circuits for power panels shall have their equipment grounding conductor connect to a ground bushing.
- H. Bare Copper Conductors: Conform to the following:
  - 1. Solid conductors: ASTM B 3.
  - 2. 2. Assembly of stranded conductors: ASTM B 8.
  - 3. 3. Tinned conductors: ASTM B 33.
- I. Underground Conductors: Bare, tinned, stranded, except as otherwise indicated.

## 2.4 MISCELLANEOUS CONDUCTORS

- A. Grounding Bus: Bare, annealed-copper. Size as indicated on drawings.
- B. Braided Bonding Jumpers: Where electrical continuity across the shock mounts is necessary, bonding jumpers shall be installed across each shock mount. Jumpers of this application should have a maximum thickness of 0.025-inch, so that the damping efficiency of the mount is not impaired. In severe shock and vibration environments, solid straps may be corrugated, or flexible wire braid may be used. Braids are to be terminated with copper ferrules.

## 2.5 CONNECTOR PRODUCTS

Exothermic Welded Connections: Provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items. All underground conductor-to-conductor connections and conductor to ground rod connections shall be made by the exothermic weld process, unless otherwise noted.

## PART-3 EXECUTION

### 3.1 APPLICATION

#### Grounding:

- A. Installation of FAA grounding requirements often exceed those of NEC; therefore, grounding system shall be installed as indicated in Contract Drawings, and as specified

herein. Reference IEEE-1100-1992, “Recommended Practice for Powering and Grounding Sensitive Electronic Equipment”, when installing equipment. In no case shall the NEC be violated.

- B. Under no circumstances shall the equipment grounding conductor be omitted from the electrical system, nor shall any separate grounding system such as electrical signal ground or direct connections to the Earth Electrode System be used for an alternate grounding system or an alternate path to the grounding electrode conductor.
- C. All ground connections to equipment shall be made with a ground connector specifically intended for that purpose.
- D. Separately Derived Systems: Where NEC requires grounding, Ground according to FAA-STD-019f.
- E. Equipment grounding conductor shall be connected to the grounded conductor (neutral) only at the service disconnecting means and at separately derived systems. This connection is sometimes called the “Main Bonding Jumper.”

### 3.2 INSTALLATION:

#### 3.2.1 Install grounding systems in accordance with:

- A. FAA-C-1217G
- B. FAA-C-1391d
- C. FAA-STD-019f
- D. Local codes.

#### 3.2.2 Service Entrance Grounding:

At the service entrance equipment, bond the service neutral, building neutral and building ground conductor to a common ground bus (or lug). Connect the ground bus (or lug) to the grounding electrodes and building water well pipe with the grounding electrode conductor. All connections at the service shall be made on ground buses (or lugs). Split bolts or cable clamps are not allowed to for this connection.

#### 3.2.3 Grounding Electrode Conductor:

This conductor shall be connected to the neutral bus in the service disconnecting means and shall extend directly to a ground rod in the grounding electrode system in one continuous unspliced run. The grounding electrode conductor shall be insulated with green insulation and sized as shown in the Contract Drawings. When not indicated in the contract documents, the conductor shall be sized in accordance with NEC Table 250-66 “Grounding Electrode Conductor for AC Systems,” except that the conductor shall not be smaller than 2 AWG per FAA-STD-019f. All grounding electrode conductors, except for those at the outdoor utility transformers, shall be routed in PVC raceway. Where the grounding electrode conductor is routed through a metal raceway or raceway, the raceway shall be electrically continuous and bonded to the conductor at each end with a solid copper conductor welded to the raceway. The grounding electrode conductor shall be connected to the Earth Electrode System by exothermic means. Make connections readily accessible for inspection. For a separately derived system such as an isolation transformer, the grounding electrode conductor shall be connected in accordance with the NEC.

### 3.2.4 Grounded Conductor (Neutral):

Shared/common neutrals (grounded conductor) shall not be permitted, i.e., each overcurrent protection device shall have its separate grounded conductor. Grounded conductors shall be sized in accordance with NEC Article 250.

### 3.2.5 Equipment Grounding Conductors

All metallic non-current carrying parts of electrical equipment shall be grounded with equipment grounding conductors whether or not shown on the drawings.

- A. Size: Size equipment grounding conductors in accordance with Table 250-122 of the NEC, "Minimum Size Equipment Grounding Conductors for Grounding Raceway and Equipment." Where ungrounded conductors are increased in size to compensate for voltage drop, the equipment grounding conductors shall be increased in size proportionately per the NEC. Minimum size shall be 12 AWG.
- B. Install equipment ground conductors in the same raceway as its related feeder and branch circuit conductors. Connect this conductor to the ground bus in the panelboard.
- C. Sharing of equipment ground conductors between circuits is not permitted. Each overcurrent protection device shall have its own separate equipment grounding conductor.
- D. Metal raceway housing the equipment ground conductors shall be electrically continuous forming a parallel path to the equipment ground conductor.
- E. All connections to equipment to be grounded shall be made with a grounding connector specifically intended for that purpose.
- F. Bare wire wrapped around connecting screws or mounting bolts and screws, is not acceptable as a ground connection. All ground lugs shall be of a non-corrosive material suitable for use as a ground connection and must be compatible with the type of metal being grounded. Ground lugs shall be mounted on clean, bare metal surfaces that are free of paint, rust, etc.
- G. Raceway or cable shields shall not be used as the equipment ground conductor.

### 3.2.6 Raceway

All metal raceways shall be grounded as follows:

- A. All joints between raceway sections and between raceway, fittings and boxes shall be electrically continuous. All pipe and lockout threads shall be treated with a conductive lubricant prior to assembly. Joints that are not otherwise electrically continuous shall be bonded with short jumpers of 12 AWG or larger copper wire. The jumpers shall be welded or brazed in place or shall be attached with clamps, split bolts, grounding bushings or other devices approved for the purpose. All bonds shall be protected against corrosion. Cover plates of raceway fittings, pull boxes, junction boxes and other outlet boxes shall be grounded by securely tightening all available screws.
- B. Every component of metallic raceway runs such as individual sections, couplings, line fittings, pull boxes, junction boxes and outlet boxes shall be bonded, either directly or indirectly, to the ground system or facility steel. Raceway brackets and hangers shall be securely bonded to the raceway and to the metal structure to which they are attached.

### 3.2.7 Equipment Enclosure Grounding

Ground all enclosures (panels, boxes, cabinets, etc.) of electrical and electronic wiring distribution equipment with approved ground lugs in accordance with the NEC.

### 3.2.8 Sleeves:

Where ground cables pass through slabs, buildings etc., and when not in metallic enclosures, provide a PVC raceway sleeve.

### 3.2.9 Fault Protection:

Prevent equipment parts subject to human contact during installation from being electrically energized during powering faults or when components fail. Ground parts with a low impedance path to the chassis or cabinets in which they are mounted.

## 3.3 CONNECTIONS:

- A. Materials procured and installed in this Section shall be in accordance with FAA-C-1217G, FAA- C-1391d, and FAA-STD-019f.
- B. Make connections so that the possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors and connection methods so metals in direct contact will be galvanically compatible.
  - a. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series:
  - b. Make connections with clean, bare metal at points of contact.
  - c. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
  - d. Where exothermic welding cannot be used or is inappropriate, use FAA approved “U” type bronze pipe connections.
- C. Exothermic-Welded Connections: Used for connections to structural steel and for underground connections. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- D. Ground lugs and bushings: Terminate insulated equipment grounding conductors for feeders with pressure-type grounding lugs. Where metallic raceways terminate at non-metallic or non-conductive housings, terminate each raceway with a grounding bushing. Connect grounding bushings with a bare ground conductor to the grounding bus in the housing. Bond electrically non-continuous raceways at both entrances and exits with grounding bushings and bare ground conductors.
- E. Torque: Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with torque tightening values specified in UL 486A.
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Mechanical connections using a Burndy “Hyground Connector” or equipment when operated at a force of 24,000 pounds are acceptable as FAA approved pressure connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on ground conductor. Hydraulically crimped connectors are not acceptable in a lightning protection system.

- G. Lug Type Connections to Equipment: Use NEMA 2-hole long barrel ground lugs with three (3) crimps. Ground lugs, connectors and other components shall comply with the NEC, latest edition.

### 3.4 BONDING REQUIREMENTS

- A. Method: At each location where raceways first penetrate a shelter or building's exterior wall direct connections shall be made to the equipment ground.
- B. Location: Bonding straps include jumpers, shall be installed in the following locations:
  - a. Bonding straps shall be attached to the basic member.
  - b. Bonding straps shall be installed to be unaffected electrically by motion or vibration.
  - c. Bonding straps shall be installed whenever possible in areas accessible for maintenance.
  - d. The method of installation and point of attachment of bonding straps shall not weaken the members to which they are connected.
- C. Bonding Straps: Bonding straps shall not be compression-fastened through non-metallic material.

### 3.5 ADJUSTING AND CLEANING

- A. Restore surface features, including vegetation, at areas disturbed by work of this Section. Reestablish original grades, except as otherwise indicated. Where sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include top soiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 26 05 00, "COMMON WORK RESULTS FOR ELECTRICAL." Maintain restored surfaces.

**END OF SECTION**



**SECTION 26 05 29**  
**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

**PART-1 GENERAL**

**1.1 SUMMARY**

- A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.
- B. Types of supports, anchors, sleeves, seals and fastenings specified in this Section include the following:
  - a. Clevis hangers
  - b. C-Clamps
  - c. Toggle bolts
  - d. One-hole raceway straps
  - e. Two-hole raceway straps
  - f. Wall and floor seals

**1.2 REFERENCE STANDARDS**

Applicable only to the extent specified.

A. Federal Aviation Administration (FAA)

FAA-C-1217G Electrical Work, Interior

FAA-STD-019f Lightning and Surge Protection, Grounding, Bonding and Shielding Requirements for Facilities and Electronic Equipment.

B. National Fire Protection Association (NFPA)

70 National Electrical Code (NEC), latest edition

C. American Standard for Testing and Materials (ASTM)

A1011 SS GR 33 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

**1.3 SUBMITTALS**

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Product data for each type of product specified.

## 1.4 QUALITY CONTROL

- A. Electrical Component Standard: Components and installation shall comply with NFPA 70, (NEC) latest edition.  
Electrical components shall be listed and labeled by UL or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

## PART-2 PRODUCTS

### 2.1 GENERAL

Materials procured and installed in this Section shall be in accordance with FAA-C-1217G, and FAA-STD-019f.

### 2.2 COATINGS

Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

### 2.3 Manufactured Supporting Devices

- A. Raceway Supports: Clevis hangers, riser clamps, raceway straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps comply with NEC, latest edition and the following requirements:
- a. Conform to manufacturer's recommendation for selection of supports.
  - b. Strength of each support shall be adequate to carry the design load plus 25 percent for future use, multiplied by a safety factor of at least of four. Where this determination results in a safety of less than 200 lbs., provide additional strength until there is a minimum of 200 lbs safety allowance in the strength of each support.
- B. Fasteners: Types, materials, and construction features as follows:
- a. Expansion Anchors: 1/2 inch lead expansion anchors approximately 38 pounds per 100 units.
  - b. Toggle Bolts: 3/16 inch by 4 inch spring head toggle bolts approximately 5 pound per 100 units.
  - c. Powder-Driven Threaded Studs: Heat-treated steel, designed specifically for the intended service.
- C. Channel Systems (U-Channel): Conform with A1011 SS GR 33. 16-gauge channels, stainless steel type 304 for outdoor locations, with 9/16-inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacturer.
- D. Raceway Sealing Bushings: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in raceways subject to exposure to water and/or oil penetration at raceway joints. Provide plugs with number and size of conductor gripping holes as required to suit installation. Construct body of malleable iron casting with hot-dipped galvanized finish.

- E. Raceway Sleeves and Seals: Provide raceway sleeves and seals of types, sizes and materials indicated with the following features:
  - a. Provide factory-assembled watertight wall and floor seals of types and sizes suitable for sealing raceway, pipe, or tubing passing through concrete floors and walls. Construct with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps and cap screws.
- F. Continuous Slotted Channels: Dimensions as required for loads imposed.
- G. Clamps: Sized for application.

## 2.4 FABRICATED SUPPORTING DEVICES

- A. General: Shop or field-fabricated supports or manufactured supports assembled from U-channel components.
- B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.
- C. Pipe Sleeves: Provide pipe sleeves for steel pipe to be fabricated from Schedule 40 galvanized steel pipe.

## PART-3 EXECUTION

### 3.1 INSTALLATION

- A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.
- B. Coordinate with the building structural system and with other electrical installation.
- C. Raceway Supports: Comply with the NEC and the following requirements:
  - a. Conform to manufacturer's recommendations for installation of supports.
  - b. Space supports for raceways in accordance with the NEC.
  - c. Support exposed and concealed raceway within 3 feet of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported, and raceway terminals are not made with chase nipples or threadless box connectors.
  - d. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the raceway supports with no weight load on raceway terminals.
- D. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.
- E. Cable Supports:

- a. Install in strict compliance with manufacturer's instructions.
  - b. Spacing not to exceed NFPA 70, latest edition, tabulation for spacing of conductor supports.
  - c. Allow adequate slack in conductors to prevent any stress on terminations. Take into consideration conductor thermal contraction.
  - d. Train cables for a neat and orderly installation.
- F. Sleeves: Install in concrete slabs and walls for raceways and cable installations. Tighten sleeve seal nuts until sealing grommets have expanded to form a watertight seal.
- G. Fastening: Unless otherwise indicated, fasten electrical items (including but not limited to raceways, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, lighting fixtures and control components) and their supporting hardware securely to the building structure in accordance with the following:
- a. Toggle bolts on hollow masonry units;
  - b. Concrete inserts or expansion bolts on concrete or solid masonry;
  - c. Machine screws welded threaded studs, or spring-tension clamps on steel.
  - d. Sheet metal screws in partitions of light steel construction.
  - e. Threaded studs, driven by a powder charge and provided with lock washers and nuts, may be used instead of expansion bolts and machine or wood screws.

Do not weld raceway (with the exception of exothermic welds for grounding), pipe straps, or items other than threaded studs to steel structures.

- a. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.
  - b. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration and shock-resistant fasteners for attachments to concrete slabs.
- H. Tests:
- a. Test pull-out resistance of one of each type, size, and anchorage material for the following fastener types:
    - i. Expansion anchors.
    - ii. Toggle bolts.
    - iii. Powder-driven threaded studs.

**END OF SECTION**

SECTION 26 05 33  
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART-1 GENERAL

1.1 SUMMARY

- A. This Section includes furnishing material, equipment, labor and incidentals necessary to install a complete and operational system of raceways, fittings, boxes, enclosures, and cabinets for each type of electrical system.
- B. Types of raceways in this Division include the following:
  - a. PVC coated rigid steel.
  - b. Polyvinyl chloride raceway (PVC).
  - c. Rigid steel (metal) raceway, zinc coated (RGS or RSC).
  - d. Electrical metallic tubing (EMT).
  - e. Liquidtight flexible metal raceway (LFMC).
- C. Types of boxes, enclosures, and cabinets in this Division include the following:
  - a. Outlet boxes.
  - b. Pull and junction boxes.
  - c. Cabinets and enclosures with hinged covers.

1.2 REFERENCE STANDARDS

The current issues of the following documents in effect on the date of the Request-For-Offers from part of this Specification and are applicable to the extent specified herein:

1.2.1 American National Standards Institute (ANSI)

- C80.1 Rigid Steel Raceway, Zinc-Coated RGS.
- C80.3 Electrical Metallic Tubing, Zinc-Coated (EMT).
- C80.6 Intermediate Metal Raceway (IMC) Zinc-Coated
- 870 Wireways, Auxiliary Gutters and Associated Fittings

1.2.2 Federal Aviation Administration (FAA)

- FAA-STD-019f Lightning Protection, Grounding, Bonding and Shielding Requirements for Facilities.
- FAA-C-1217G Electrical Work, Interior.
- FAA-C-1391d Installation, Termination, Splicing, and Transient/Surge Protection of Underground Electrical Distribution System Power Cables

1.2.3 Federal Specifications (FS)

- W-C-586 Raceway Outlet Boxes, Bodies, and Entrance Caps.

1.2.4 National Electrical Manufacturers Association (NEMA)

- FB1 Fitting, Cast Metal Boxes, and Raceway Bodies, and Cable Assemblies
- OS1 Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
- 250 Enclosures for Electrical Equipment (1000 Volts and Below)
- ICS-6 Industrial Control System Enclosure.
- RN1 Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Raceway.

1.2.5 National Fire Protection Association (NFPA)

- 70 National Electrical Code (NEC), latest edition

1.2.6 Occupational Safety and Health Administration (OSHA)

- 29CFR1910.7 Definitions and Requirements for a Nationally Recognized Testing Laboratory (NRTL)

1.2.7 Underwriters Laboratories (UL). Materials having UL listing shall bear the UL label.

- 6 Rigid Metal Raceway
- 50 Enclosures for Electrical Equipment
- 360 Liquid-tight Flexible Metal Raceway
- 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors
- 514A Metallic Outlet Boxes
- 514 B Fittings for Raceway and Outlet Boxes
- 797 Electric Metallic Tubing
- 870 Wireways, Auxiliary Gutter, and Associated Fittings.
- 1242 Intermediate Metal Raceways
- 651 PVC Raceway

1.2.8 Steel Structures Painting Council (SSPC)

- PS-10.01 Hot-applied coal tar enamel painting system.

1.3 SUBMITTALS

Parsons WRPM approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Manufacturer's product data for all raceway and fittings, floor boxes, hinged cover enclosures, and cabinets. Include specifications, installation instructions and general recommendations.

1.4 APPLICATIONS:

Boxes shall be provided in the wiring and raceway system for pulling wires, making connections.

## 1.5 QUALITY CONTROL

- A. Comply with latest edition of the NFPA 70 "National Electrical Code" latest edition for components and installation.
  - a. Boxes shall be sized in accordance with NEC Article 370.
- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
  - a. The Terms "Listed and Labeled": As defined in the "National Electrical Code," Article 100.
  - b. Listing and Labeling Agency Qualifications: A NRTL as defined in OSHA Regulation 1910.7.
- C. Comply with NECA "Standard of Installation."
- D. Coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

## 1.6 SHOP DRAWINGS

Submit dimensioned drawings of raceway and wireway systems showing layout of raceway at all congested areas such as above and below panelboards.

## PART-2 PRODUCTS

### 2.1 GENERAL:

- A. Enclosures shall conform to NEMA standards.
- B. All materials procured under this specification shall be in accordance with FAA-C-1217G, and FAA-STD-019f.
- C. Raceway size: Raceways shall be adequately sized to include the phase conductors, an equipment ground conductor (green) and a neutral conductor (gray or white) in accordance with percentage fill requirements by NFPA 70 (NEC) latest edition. Note: Per FAA-STD-019f, equipment grounding conductors are sized the same as phase conductors, impacting raceway size.
  - a. Provide 1/2 inch raceway minimum unless otherwise indicated on Contract Drawings.

### 2.2 RACEWAY AND TUBING

- A. Rigid Steel Raceway: Heavy wall mild steel tube with metallic corrosion resistant coating on exterior and interior, hot dipped galvanized steel, free from defects; Manufactured in accordance with Federal Specification W-C-581, ANSI C80.1 and UL 6.
- B. PVC Coated Steel Raceway: Meeting the requirements of Rigid Steel Raceways; 40mil PVC exterior coating and urethane interior coating, in accordance with NEMA RN 1.
- C. Electrical Metallic Tubing: Welded steel tubing, formed of low carbon steel, electro-galvanized exterior, inside coated with a baked, elastic low-friction coating of enamel, in accordance with Fed. Spec. WW-C-563, ANSI C80.3 and UL 797.
- D. Liquidtight Flexible Metal Raceway (LFMC); Flexible steel raceway with PVC jacket: Liquidtight raceway shall have an extruded, polyvinyl jacket over the flexible metal in accordance with UL 360
  - a. Flexible non-metallic raceway shall not be used.

- E. Rigid Non-Metallic Raceway (PVC): Schedule 80 high impact, polyvinyl chloride, in accordance with Federal Specification W-C-1094 and UL 651 listed.

## 2.3 RACEWAY FITTINGS, COUPLINGS AND CONNECTORS

- A. Material: Use fittings listed and approved for specific raceway or raceway system used.
- B. Bushings and connectors: Bushings and connectors shall be insulated type which maintain continuity of raceway ground system. Insulating material shall be molded or locked into metallic body of the fitting. Bushing made entirely of nonmetallic material will not be allowed.
- C. Fittings and Raceway Bodies: UL 514B and NEMA FB 1, compatible with raceway and of the threaded type.
  - a. Rigid Steel Raceway: Threaded type material to match the raceway, in accordance ANSI/NEMA FB1.
  - b. Rigid Non-Metallic Raceway: Solvent-welded, slip-on joints.
  - c. Below Grade Installations: For installation below slab, on-grade, or underground, the raceway shall be factory coated with either 0.008 inch of epoxy, 0.020 inch of polyvinyl chloride or 0.063 inch of coal-tar enamel or shall be field wrapped with 0.01 inch thick pipe wrapping plastic tape applied with 50% overlap.
  - d. Electrical Metallic Tubing: Fittings used with EMT shall be compression-type fittings designed for this type of raceway, unless otherwise indicated. Screw-type fittings are not acceptable. Connectors shall have insulated-throat, smooth bell shaped end or a bushing.
  - e. Set Screw fittings are not allowed.
  - f. Wedge and screw type having an angular wedge fitting between the convolutions of the raceway.
  - g. Squeeze or clamp type having a bearing surface contoured to wrap around the raceway and clamped by one or more screws.
  - h. Steel, multiple point type, for threading into the internal wall of the raceway convolutions.
  - i. Inferior material such as “pot metal” shall not be used for any type of fitting.
  - j. All locknuts shall be of the bonding type with sharp edges for digging into the metal wall of the enclosure.
- D. Frangible Couplings: Frangible couplings shall break away with applied load not to exceed 75 lbs. The frangible coupling and mounting flanges shall be designed for use with 2-inch (51 mm) electrical metallic tubing (EMT) and shall be suitable for mounting on a concrete pad. Anti –seizing compound shall be applied on the threads of the frangible couplings prior to insertion into the rigid couplings and mounting flanges.

## 2.4 OUTLET BOXES

- A. Sheet Metal Boxes: NEMA OS 1 and UL 514A; Galvanized steel with 1/2 inch male fixture studs where required.
- B. Cast Metal Boxes: NEMA FB 1, type FD, cast alloy box with gasketed cover, threaded hubs. Use cast boxes for damp and outdoor locations.
- C. Fittings: UL 514B



## 2.5 PULL AND JUNCTION BOXES:

- A. Small Sheet Metal Boxes: NEMA OS 1 and UL 514A.
- B. Cast Metal Boxes:
  - a. Threaded-hub type conforming to UL 514A and UL 514B.
  - b. Galvanized steel conforming to UL 514A and UL 514BB
- C. Covers: Class 30B gray cast iron conforming to ASTM-8, machine finished with flat bearing surfaces.

## 2.6 INTERIOR/EXTERIOR CABINETS AND ENCLOSURES

- A. Hinged Cover Enclosures: NEMA 250, steel enclosure with continuous hinge cover and flush latch. Finish inside and out with manufacturer's standard enamel.
- B. Cabinets and enclosures: NEMA 250, code gauge galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment. Cabinets and enclosures shall be constructed with interior dimensions not less than those:
  - a. Indicated on the Contract Drawings.
  - b. Provide 5/8 inch plywood backboard unless otherwise indicated.
  - c. Key latch to match panelboards. Provide two keys with each cabinet unless otherwise notified.
  - d. Interior cabinets and enclosures shall be rated NEMA 1.
  - e. Exterior cabinets and enclosures for power equipment shall be rated NEMA 3R.
  - f. Exterior cabinets and enclosures for splice/communication/control shall be rated NEMA 4X (fiberglass).
  - g. Exterior cabinet front covers shall have a minimum of one (1) latch or securing device on each of the three non-hinged sides. If the cabinet cover is not hinged it shall have a minimum of one (1) latch or securing device on each of the four sides.
- C. Safety: UL 50
- D. Locks: All locks in this project shall be keyed alike.

## PART-3 EXECUTION

### 3.1 PREPARATION

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of the raceway system. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Examine raceways prior to installation. No crushed or deformed raceway shall be installed.
- C. Provide electrical boxes in locations shown on the plans and as required for splices taps, wire pulling equipment connections and code compliance.

## 3.2 WIRING METHODS

### A. Outdoors: Use the following wiring methods:

- a. Underground Encased Concrete Ductbank: Rigid galvanized steel raceway and fittings.
- b. Exposed: Rigid steel raceway, unless otherwise indicated on Contract Drawings.
- c. Underground, Single or Grouped Run: Rigid steel/PVC raceway and fittings as indicated on Contract Drawings.
- d. Connection to Vibrating Equipment (including transformers) liquid-tight flexible metal raceway.
- e. Boxes and Enclosures: NEMA Type 3R and/or Type 4X, as specified in Part 2.

### B. Indoors: Use the following wiring methods:

- a. Connection to Vibrating Equipment: Flexible metal raceway, except in wet or damp locations, use liquid-tight flexible metal raceway.
- b. Damp or Wet Locations: Rigid steel raceway.
- c. Exposed: Rigid steel raceway. Rigid steel raceway shall be used in the electrical/mechanical rooms to a height of 8 feet above finished floor.
- d. Boxes and Enclosures: NEMA Type 1.

### C. Raceway Use:

- a. Install rigid steel raceway (RSC) for all distribution panel feeders, transformer feeders.
- b. Use rigid steel or PVC raceway and fittings for underground ductbanks as indicated on Contract Drawings.
- c. Use PVC coated rigid galvanized steel raceway for all raceway systems installed in contact with earth.
- d. Ends of raceway systems not terminated in boxes or cabinets shall be capped.
- e. Where raceways enter enclosures without hubs, an appropriate connector with threads and locknuts shall be used to securely bond the raceway to the enclosure.
- f. The connector body and locknut shall be installed so that firm contact is made on each side of the enclosure. In addition, the connector shall be the insulated-throat type.
- g. EMT may be used only in dry interior locations, and where not subject to physical damage.
- h. EMT shall not be used on circuits above 600 volts or in sizes greater than 4 inches in diameter.
- i. EMT shall be used above grade in conjunction with frangible fittings as indicated on Contract Drawings.

## 3.3 INSTALLATION:

### 3.3.1 Products shall be installed in accordance with:

- A. FAA-C-1217G
- B. FAA-C-1391d
- C. FAA-STD-019f

### 3.3.2 Raceway:

- A. Minimum size for raceway power circuits shall be 1/2 inch, unless otherwise noted.
- B. Raceway for telephone and signal systems shall be as follows:
  - a. 1/2-inch raceway may be used for lengths not exceeding 50 feet. 3/4-inch raceway may be used for lengths not exceeding 100 feet.
  - b. 1-inch raceway shall be used for lengths exceeding 100 feet.
- C. No run shall contain more than four (4) 90-degree bends, or the equivalent between boxes. Provide pull and junction boxes required to meet this criteria.
- D. Size raceways as required by the NEC for the number and sizes of wires to be pulled into the raceway.
- E. Use raceway bodies to make sharp changes in directions around ground beams.
- F. Use temporary closures/caps to prevent foreign matter and moisture from entering raceway.
- G. Use raceway fittings suitable for use and location.
- H. Raceway under/embedded in slabs: Install in middle third of the slab thickness where practical, and leave at least 1 inch concrete cover.
  - a. Secure raceway to reinforcing rods to prevent sagging or shifting during concrete placement.
  - b. Space raceway laterally to prevent voids in the concrete.
  - c. Run raceway larger than 1-inch trade size parallel to or at right angles to main reinforcement. When at right angles to reinforcement, place raceway close to slab support.
- I. For installation below slab, on-grade, or underground, the Rigid Steel Raceway shall be PVC coated, 0.063 inch of coal-tar enamel or shall be field wrapped with 0.01 inch thick pipe wrapping plastic tape applied with 50% overlap. Fittings used underground shall be protected by field wrapping as specified herein for raceway.
- J. Field Cut Raceway: Where raceway has to be cut in the field, it shall be cut square using a hand or power hacksaw or approved pipe cutter using cutting knives. The cut ends of the field-cut raceway shall be reamed to remove burrs and sharp edges.
- K. Field Threaded Raceway: Where threads have to be cut on raceway, the threads shall have the same effective length and shall have the same thread dimension and taper as specified for factory-cut threads on raceway.
- L. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely, and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, or where raceways enter enclosures without threaded hubs, use two locknuts, one inside and one outside the box to securely bond the raceway to the enclosure.
  - a. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.
- M. Bushings: Install a bushing on the interior threaded end of each raceway to protect conductor insulation.

- N. Make bends and offsets so the inside diameter is not reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel. Where space conditions prohibit the use of standard elbows, use ferrous alloy fittings to match the raceway construction. "Condulet" type fittings shall not be used on raceways containing 4 AWG or larger wire.
  - a. Bends in raceway that is 1 inch and larger shall have a minimum inside radii 12 times the nominal raceway diameter.
- O. Frangible Couplings: The point of frangibility shall be located no higher than 3-inches above grade when installed.

### 3.3.3 Raceways

Complete raceway installation before starting conductor installation. Inside of raceways shall be reamed, deburred, fished and swabbed before conductors are pulled.

### 3.3.4 Support:

Support raceways, boxes, cabinets and enclosures in accordance with Section 26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS.

### 3.3.5 Floor and Wall Penetrations:

- A. Penetrations through walls or floors separating the building interior from the exterior shall be sealed to prevent moisture and rodent entry and to deter air transfer.
- B. Seal penetrations of walls which separate individually temperature or humidity controlled areas, to prevent air circulation.
- C. Raceway sealing methods and sealants shall be in accordance with the NEC.
- D. Conceal raceway unless otherwise indicated, within finished walls and ceilings.

### 3.3.6 Exposed Raceways:

Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.

- A. Run parallel or banked raceways together, and on common supports where practical.
- B. Make bends in parallel or banked runs from same center line to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field bends for parallel raceways.
- C. Install raceways at proper elevations. Provide adequate headroom.

### 3.3.7 Joints:

Join raceways with fittings designed and approved for the purpose and make joints tight.

- A. Use bonding locknuts and bushings at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
- B. Use insulating bushings for all raceways to protect conductors.

### 3.3.8 Pull Wire:

Install pull wires in empty raceways. Use 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-LB tensile strength. Leave not less than 24 inches of slack at each end of the pull wire.

### 3.3.9 Stub-Up Connections:

Extend raceways through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs, and set flush with the finished floor. Extend conductors to equipment with rigid steel raceway. Flexible raceway may be used 6 inches above the floor/pad in coordination with PM. Where equipment connections are not made under this Contract, install screwdriver-operated threaded flush plugs flush with floor. Protect stub-ups from damage where raceways rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

### 3.3.10 Flexible Connections:

- A. Flexible, liquid tight metal raceway:
  - a. Use maximum of 6 feet of flexible raceway for equipment subject to vibration, noise transmission, or movement; in wet or damp outdoor locations; and for all motors.
  - b. May be used for branch circuits in lengths longer than 6 feet in computer room locations which meet requirements of NEC Article 645.
  - c. Fittings and junction boxes shall be liquid tight under raised floors.
- B. A separate ground conductor shall be provided across all flexible raceway in addition to the equipment ground conductor run in the raceway with its related power conductors. This conductor shall be bonded to the connecting device at each end of the flexible raceway.

### 3.3.11 Boxes:

- C. Boxes shall be provided in the wiring or raceway system for pulling wires, making connections, and mounting devices and fixtures. Each box shall have the volume required by the NFPA 70 for the number and size of conductors in the box.
  - a. Pull/Junction Boxes: Installation shall be plumb and level. Bring pull boxes tops flush with finished grade. Install type suitable for location (interior/exterior, dry/damp/wet).
  - b. Outlet Boxes: Each outlet box shall have a machine screw which fits into a tapered hole into the box for the ground connection
  - c. Wet locations: Cast metal boxes installed in wet locations and boxes installed flush with exterior surfaces shall be gasketed.
  - d. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
  - e. Support boxes in accordance with Section 26 05 29 HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS. Minimum support shall be at each corner.
  - f. EMT entering an enclosure without threaded hubs: Provide a connector with threads and cast or machine lockout. The connector body and locknut shall be installed so that firm contact is made on each side of the enclosure.
  - g. Ends of raceway not terminated in boxes or cabinets shall be capped to protect against entry of dirt and moisture.
  - h. Locate and install boxes to allow access. Where installation is inaccessible, coordinate locations and sizes of required access doors in accordance with other sections of the specification.
- D. Subcontractor shall coordinate with other trades and shall determine proper placement and mounting heights of all devices.

### 3.3.12 Grounding:

Install grounding connections for raceway, boxes, and components in accordance with Section 26 05 26.

### 3.3.13 Protection

Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, to ensure that coatings, finishes, and cabinets are without damage or deterioration at Substantial Completion.

- E. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
- F. Repair damage to paint finishes with matching touch-up coating recommended by the manufacturer.

## 3.4 ADJUSTING AND CLEANING

- A. Upon completion of installation of system, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions and cover raceways and boxes to prevent entrance of foreign matter, paint, etc.
- B. Remove dirt and construction debris from outlet, junction, and pull boxes, and cabinets. Deformed raceways, boxes, cabinets and enclosures shall be replaced.
- C. Run a swab or mandrel to remove dirt or blockages from raceways.

**END OF SECTION**

**SECTION 26 05 33.10**  
**UNDERGROUND CONDUITS FOR ELECTRICAL SYSTEMS**

**PART 1- GENERAL**

**1.1 SUMMARY**

This Section includes furnishing labor, materials, equipment, and incidentals necessary to install underground conduits and ducts, duct banks, pull cords, duct markers, capping of conduits, handholes, manholes, and other underground utility structures in accordance with dimensions, designs and details shown on the Contract Drawings Contract Drawings. This Section also includes the testing of the installation as a completed

**1.2 REFERENCE STANDARDS**

- A. American National Standards Institute (ANSI)
  - 1. C2 National Electrical Safety Code
  - 2. C80.1 Rigid Steel Conduit, Zinc-Coated
  
- B. Federal Aviation Administration (FAA)
  - 1. FAA-C-1217g Electrical Work, Interior
  - 2. FAA-C-1391d Installation, Termination, Splicing, and Transient/Surge Protection of Underground Electrical Distribution System Power Cables
  
- C. American Society for Testing and Materials (ASTM)
  - 1. C270 Specification for Mortar for Unit Masonry
  - 2. C387 Specification for Packaged, Dry, Combined Materials for Mortar and Concrete
  - 3. C857 Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
  - 4. C858 Specification for Underground Precast Concrete Utility Structures
  - 5. C891 Specification for Installation of Underground Precast Concrete Utility Structures.
  - 6. C1037 Standard Practice for Inspection of Underground Precast Concrete Utility Structures
  
- D. National Fire Protection Association (NFPA)
  - 1. 70 National Electrical Code (NEC), latest edition

- E. Occupational Safety and Health Administration (OSHA)
  - 1. 29CFR Definitions and Requirements for a Nationally Recognized Testing Laboratory (NRTL).
- F. National Electrical Manufacturers Association (NEMA)
  - 1. TC2 Standard for Electrical Polyvinyl Chloride (PVC) Conduit
  - 2. TC3 Polyvinyl Chloride (PVC) Fittings for use with Rigid PVC Conduit and Tubing.
- G. Underwriters Laboratory (UL)
  - 1. 651 UL Standard for Safety Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.

### 1.3 DEFINITIONS

- A. Duct: Electrical conduit and other raceway, used underground, embedded in earth or concrete.
- B. Duct Bank: 2 or more conduits or other raceway installed underground in the same trench or concrete envelope.
- C. Handhole: An underground junction or pull box interconnected with a duct or duct bank.

### 1.4 SUBMITTALS

Parsons WRPM approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Product data for metal accessories for handholes, conduit and duct, duct bank materials, trench marking tape and miscellaneous components.
- B. Certificate for concrete and steel used in underground precast concrete utility structures, according to ASTM C 858.
- C. Inspection report for factory inspections, according to ASTM C 1037.
- D. Coordination drawings showing duct profiles and coordination with other utilities and underground structures. Include plans and sections drawn to accurate scale.
- E. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their expertise, capabilities and experience.
- F. Field test reports indicating and interpreting test results relative to compliance with performance requirements of "Field Quality Control" Article in Part 3 of this Section.
- G. Record Documents: Show dimensioned locations of underground ducts and handholes.



## 1.5 QUALITY CONTROL

- A. Manufacturer Qualifications: Firm experienced in manufacturing underground precast concrete utility structures of types and sizes required and similar to those indicated for this Project. Firm must have a record of successful in-service performance.
- B. Comply with NFPA 70, NEC latest edition, and ANSI C2 for components and installation.
- C. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
  - a. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
  - b. Listing and Labeling Agency Qualifications: A NRTL as defined in OSHA Regulation 1910.7.
- D. Coordinate layout and installation of ducts and ductbank handholes with final arrangement of other utilities as determined in the field.
- E. Coordinate elevations of duct and duct bank entrances into handholes with final profiles of conduits as determined by coordination with other utilities and underground obstructions. Revise locations and elevations from those indicated as required to suit field conditions and ensure duct runs drain to handholes, and as approved by the PM Designee.
- F. Install underground ductbanks and handholes in accordance with the requirements of the local power company and local telecommunications company, as appropriate.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ducts to site with ends capped.
- B. Store precast concrete units at site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

## PART-2 PRODUCTS

### 2.1 MATERIALS

All equipment and materials covered by this referenced specification shall be subject to acceptance through the manufacturer's certification of compliance with the applicable specification when so requested by the PM Designee.

- A. Concrete: Concrete for precast handholes shall be the manufacturer's standard mix for obtaining minimum compression strength of 3000psi or as shown on Contract Drawings. Concrete shall be air entrained. Concrete shall conform to the requirements of Section 03 00 00 CONCRETE.
- B. Mortar: Conform to ASTM C270, Type M, except for quantities less than 2.0 cu. ft. (60 L), where packaged complying with ASTM C387, Type M may be used.

C. Handholes: Provide pre-cast handholes as follows:

1. Dimensions shall be as noted on Contract Drawings.
2. The number of conduit or terminators entering the handhole shall not be less than as detailed on the plans. Provide knockouts windows in unused sides of the handhole and sleeves for ground connection.
3. Interlocking, mating sections, complete with accessory items, hardware, and features as indicated.
4. Joint Sealant: Continuous extrusion of asphaltic butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand the maximum hydrostatic pressures at the installation location with the ground water level at grade.
5. Design structure according to ASTM C858.
6. Structural Design Loading: ASTM C857, Class A-16.
7. Fabricate according to ASTM C858.
8. Design loads shall consist of dead load, live load, impact load, loads due to water table and any other loads which may be imposed upon the structure. Live loads shall be for Aircraft or H2O loading as shown on Contract Drawings.
9. Prepare and submit detailed shop drawings for pre-cast handholes indicating reinforcement, dimensions and details of each miscellaneous item. The handhole design shall be checked by a Registered Professional Engineer in the state where project is located. All handhole drawings shall bear Registered Professional Engineers Seal and signature.
  - a. All shop drawings shall be checked by the fabricator before being submitted for approval to the Subcontract Administrator.
  - b. The Subcontractor shall be responsible for the correctness and completeness of the drawings and fit and field connections even if the drawings have been approved by the Subcontract Administrator.
10. All reinforcing steel, including welded wire mesh, shall be of the size and in the location as shown on the plans. All reinforcing shall be sufficiently secured to withstand any displacement during the pouring operation. Reinforcing steel shall conform to the requirements of Section 03 00 00 CONCRETE
11. Duct terminators:
  - a. Terminators shall be formed of high impact, high strength, prime virgin acrylonitrile butadiene styrene (ABS) plastic, containing the proper number, size, and arrangement of openings to receive ducts as shown on the plans, with 2-inch nominal separation between openings.
  - b. Terminators shall be hollow, to allow placement of reinforcing steel inside. Terminators shall provide for reception of future ducts and factory plastic plugs of proper size. Plugs shall be furnished and installed in all empty duct openings. Installation in handholes shall be in accordance with manufacturer's instructions.

12. Covers shall be bolt down type. Covers shall have built-in, flush lifting eyes for ease of cover lifting. Bolted-on or U-bolt type devices shall not be acceptable as cover lifting eyes.
  13. Frames and covers shall be constructed of the materials as specified and in accordance the details shown on the plans and shall be placed carefully to the lines or grades indicated on the plans or as directed by the PM Designee. Covers shall be stamped "Power," "Control" "Telco" or "Comm." as applicable.
  14. Source Quality Control: Inspect structures according to ASTM C1037.
- D. Trench marking Tape: All duct banks shall be marked with marking tape. Tape shall run continuous in the trench 6 inches below the surface or as indicated on the drawings. Marking tape shall be red, bright orange or yellow colored tape. Lettering shall read "Power," "Control," or "Comm." as applicable.

## 2.2 CONDUIT AND DUCT

- A. Rigid Steel Conduit (RSC): ANSI C80.1, galvanized
- B. Rigid Non-Metallic Conduit (PVC): Schedule 80 high impact, polyvinyl chloride, in accordance with Federal Specification W-C-1094 and Underwriters Laboratories Standards UL-651 and 651A.
- C. Accessories:
  - a. Duct Supports: Rigid PVC spacers selected to provide minimum duct spacings and concrete cover depths indicated, while supporting ducts during concreting.
  - b. Grounding: Provide grounding in accordance with Section 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
  - c. Duct Sealing Compound: Non-hardening, safe for human skin contact, not deleterious to cable insulation, workable at temperatures as low as 35 deg F, withstands temperature of 300 deg F without slump, and adheres to clean surfaces of metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and the common metals.

## PART-3 EXECUTION

### 3.1 GENERAL

Installation shall adhere to the requirements indicated on the construction plans and details and as specified below:

- A. Underground Ducts For Electrical Utility Service: PVC or Rigid steel conduit, encased in concrete as indicated on Contract Drawings.
- B. Underground Ducts For Telecommunications Utility Service: PVC or Rigid steel conduit, encased in concrete or indicated on Contract Drawings.

## 3.2 EXAMINATION

Examine site to receive ducts and handholes for compliance with installation tolerances and other conditions affecting performance of the underground ducts and handholes. Do not proceed with installation until unsatisfactory conditions have been corrected.

## 3.3 CONDUIT AND DUCT INSTALLATION

- A. Install conduit and duct as indicated on drawings. Grading of pullboxes and associated interconnecting ducts shall be shown on the plans.
- B. Slope: All duct lines shall be laid so as to drain toward handholes, unless otherwise shown on the drawings. Pitch ducts minimum of 1 inches vertical per 100 feet to drain toward handholes and away from buildings and equipment. Slope ducts from a high point in runs between two handholes to drain in both directions.
- C. Curves and Bends: Manufactured bends shall have a minimum of 24 inches for a 2-inch duct and 48 inches for a 4-inch duct.
- D. Joints: Make joints in ducts and fittings watertight according to manufacturer's instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.
- E. Duct Entrances to Handholes: Provide ground bushings where RGS ducts enter handholes.
- F. Underground Warning Tapes: Install above all underground conduit installations. Locate six (6) inches below finished grade.
- G. Size: Where no size is indicated on the plans, the ducts shall not be less than 4 inches inside diameter.
- H. Concrete-Encased Ducts: Support on plastic separators, coordinated with duct size and required duct spacing, and install according to the following:
  - a. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, and secure separators to the earth and to ducts to prevent floating during concreting. Do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups. Minimum separator spacing shall be 5 feet.
  - b. Concreting: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not use power-driven agitating equipment unless specifically designed for duct bank application. Pour each run of envelope between manholes or other terminations in 1 continuous operation. When more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into the concrete on both sides of joint near the corners of the envelope.
  - c. Reinforcing: Reinforce duct banks where they cross high traffic areas. Install reinforcing in duct banks passing through disturbed earth near buildings and other excavations. Coordinate duct bank with structural design to support duct bank at wall without reducing structural or watertight integrity of building wall.

- d. Forms: Use the walls of the trench to form the side walls of the duct bank where the soil is self-supporting and concrete envelope can be poured without soil inclusions, otherwise, use forms.
  - e. Minimum Clearances Between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 12 inches between power and signal ducts.
  - f. Depth: Except as otherwise indicated, install top of duct bank at least 36 inches below finished grade.
  - g. Obstructions: In the event any obstructions are encountered, the Subcontractor shall inform the PM Designee immediately.
  - h. Install trenches for duct banks in accordance with pertinent requirements of all sections of this Specification.
  - i. Assemble duct joints with a solvent cement for conduit type and applied as directed by the manufacturer. Stagger any duct joints in the duct bank, both horizontally and vertically, a minimum of one foot to increase structural integrity of the duct bank installations. No two duct joints shall lie in the same transverse plane in a vertical or horizontal direction. These provisions shall also apply at all ducts installed for future extensions
  - j. The Subcontractor shall notify the PM Designee at least six hours before starting to place backfill in any duct to permit the inspection of ducts and spacers. Where mechanical compactors are used, care shall be taken so as to not injure and displace the ducts.
- I. Stub-Ups: Use rigid steel conduit for stub-ups to equipment. Install insulated grounding bushings on the terminations.
  - J. Sealing: Provide temporary closure at terminations of ducts that are wired under this Project. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15 psi hydrostatic pressure.
  - K. Pulling Cord: Polyolefin pull line with a minimum tensile strength of 200 pounds shall be provided in conduits installed for future use.
  - L. Conduit Joints: Joints in plastic conduit shall be installed in accordance with the manufacturer's recommendations for the particular type of conduit.
  - M. Duct Cleaning: Mandrel each duct. An iron-shod mandrel, not more than 1/4 inch smaller than the bore of the duct shall be pushed through each duct by means of jointed conduit rods. The mandrel shall have leather or rubber gasket slightly larger than the duct hole. The Subcontractor shall completely and thoroughly swab clean each duct prior to cable installation.
  - N. Conduit Termination: Conduit shall terminate in duct terminators where the duct lines enter handholes. Where conduit risers are exposed above grade or slab, convert to RGS including last elbow below grade.

- O. Changes in direction: Changes in direction of runs exceeding a total of 10 degrees, either horizontal or vertical, shall be accomplished by field preparation and installation of long sweep bends having a minimum radius of curvature of 25 feet, in order to avoid kinks in the conduit, except that manufactured bends may be used at the ends of the run. The long sweep bends may be made up of one or more curved or straight sections and/or combinations thereof.
- P. Ducts: Spare ducts at the entrance to handholes, shall be plugged with a removable tapered plug, designed by the duct manufacturer, or with hardwood plugs conforming accurately to the shape of the duct and having the larger end of the plug at least 1/4 inch greater in diameter than the duct.
  - a. All ducts shall be securely fastened in place during construction and shall be plugged to prevent seepage of grout, water or dirt. Any duct section having a defective joint shall be repaired or replaced prior to backfill.

### 3.4 UNDERGROUND UTILITY STRUCTURE INSTALLATION

- A. Elevation: Install handholes with roof of handhole at finished floor or grade. Install handholes with depth as required based on ductbank elevations and sloping requirements.
- B. Access: Install cast-iron frame and cover. Install handhole cover as indicated on Contract Drawings.
- C. Cast-In-Place Underground Structure Installation: Conform to applicable requirements of Section 03 00 00 CONCRETE.
- D. Finish interior surfaces with a smooth troweled finish.
- E. Precast Underground Structure Installation: Install as indicated on Contract Drawings and according to manufacturer's written instructions and ASTM C891.
  - a. Install units plumb and level and with orientation and depth coordinated with arrangement of connecting ducts to minimize bends and deflections required for proper entrances.
  - b. Support units on a level bed of crushed stone or gravel, graded from the 1-inch sieve to the No. 4 sieve and compacted to same density as adjacent undisturbed earth.
  - c. Defects: Minor cosmetic defects in the concrete which do not affect the strength of the handhole, or expose the steel reinforcement, maybe accepted if the defects are properly patched and do not cover more than a total area of 4 square feet.
  - d. Joints: The joints between different handholes shall provide a surface area of sufficient size and dimensions to provide adequate lateral strength and prevent moisture egress with the sealant provided by the manufacturer. All joints shall be on the horizontal plane with a maximum of two joints per box. The joint utilized between sections shall be as indicated in the Contract Drawings. The separation between different handhole sections at joints shall not vary more the 2 inches from the point of least separation to the greatest separation. Excess sealant shall be

removed and surface projections shall be removed before backfill operations begin.

### 3.5 EARTHWORK

Excavation, Backfill and Compacting: Conform to Section 31 23 00 EXCAVATION AND FILL but do not use heavy-duty hydraulic-operated compaction equipment.

### 3.6 RESTORATION

All areas disturbed by the trenching, storing of dirt, cable laying and other work shall be restored to its original condition in accordance with Division 2. The Subcontractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance.

### 3.7 FIELD PREPARATION

The Subcontractor shall prepare a hole large enough to accommodate the outside dimensions of the Structure as shown on the drawings.

- A. Prior to setting, the Subcontractor shall provide 6"-8" inches of 3/4 inch crushed stone as a base to receive the handhole.
- B. The base material shall be compacted and graded level and at proper elevation to receive the handhole in proper relation to the conduit grade and ground cover requirements as shown on the plans.
- C. After primary structure has been properly installed, excavation shall be backfilled.

### 3.8 MISCELLANEOUS ITEM INSTALLATION

- A. Welding will not be permitted unless shown otherwise on the approved shop drawings. Equipment shall be suitable and safe for the workman. Errors in shop fabrication or deformation resulting from handling and transportation that prevent the proper assembly and fitting of parts shall be reported immediately to the PM Designee and approval of the method of correction shall be obtained. Approved corrections shall be made at the Subcontractor's expense.
- B. Anchor Bolts: Anchor bolts and anchors shall be properly located and built into connection work. Bolts and anchors shall be preset by the use of templates or such other methods as may be required to locate the anchors and anchor bolts accurately. All miscellaneous items shall be galvanized.
- C. Adjustment: After assembly, the various members shall be aligned and adjusted accurately before being fastened.
- D. Galvanizing touchup: Apply liquid-cold galvanizing compound conforming to U.S. Navy Galvanizing Repair Specification MIL-P-21035 to galvanized surfaces damaged during installation. Surfaces shall be cleaned and compound applied in accordance with manufacturer's recommendation.

- E. Grounding: Install handhole grounding in accordance with Section 26 05 26  
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

### 3.9 FIELD QUALITY CONTROL

- A. Testing: Demonstrate capability and compliance with requirements upon completion of installation of underground duct and utility structures.
  - a. Grounding: Test handhole grounding in accordance with Section 26 05 26  
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
  - b. Duct Integrity: Rod ducts with a mandrel 1/4 inch smaller in diameter than internal diameter of ducts. Where rodding indicates obstructions in ducts, remove the obstructions and retest.
- B. Correct installations where possible, and retest to demonstrate compliance. Otherwise, remove and replace defective products and retest.

### 3.10 CLEANING

- A. Pull brush through full length of ducts. Use round bristle brush with a diameter 1/2 inch greater than internal diameter of duct.
- B. Clean internal surfaces of handholes including sump. Remove foreign material.

**END OF SECTION**



**THIS PAGE INTENTIONALLY LEFT BLANK**

**SECTION 26 05 53**  
**IDENTIFICATION OF ELECTRICAL SYSTEMS**

**PART-1 GENERAL**

**1.1 SUMMARY**

- A. This Section includes identification of electrical materials, equipment, and associated installation. It includes requirements for electrical component identification, including but not limited to the following:
1. Buried electrical line warnings
  2. Identification labeling for raceways, cables, and conductors
  3. Equipment labels and signs
  4. Panel Schedules

**1.2 REFERENCE STANDARDS**

Applicable only to the extent specified.

- A. American Standards Institute (ANSI)
1. A13.1 Scheme for the Identification of Piping Systems
- B. Federal Aviation Administration (FAA)
1. FAA-C-1217G Electrical Work, Interior
- C. National Fire Protection Association (NFPA), latest edition
1. NFPA 70 National Electrical Code (NEC), latest edition

**1.3 SUBMITTALS**

Parsons WRPM approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Product Data: Product Data for each type of product specified.
- B. Schedule: Schedule of identification nomenclature, abbreviations and equipment designations to be used for identification signs.
- C. Samples: Samples for each color, lettering style, and other graphic representation required for identification materials; samples of labels and signs.
- D. Text: Size and lettering text on each nameplate.

**1.4 QUALITY CONTROL**

- A. Electrical Component Standard: Components and installation shall comply with NFPA 70 latest edition.

1. ANSI Compliance: Comply with requirements of ANSI standard A13.1, "Scheme for Identification of Piping Systems", with regard to type and size of lettering for raceway and cable labels.
2. National Fire Protection Association (NFPA): Comply with NFPA 70, latest edition, requirements for Identification and for provision of warning and caution signs for wiring and equipment.

## 1.5 SEQUENCING AND SCHEDULING

Coordinate installing electrical identification after completion of finishing where identification is applied to field-finished surfaces.

## PART-2 PRODUCTS

### 2.1 GENERAL

- A. Materials shall be in accordance with FAA-C-1217G.
- B. Except as otherwise noted provide manufacturer's standard products of categories and types required for each application.
- C. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations used in the Contract Documents or required by codes and standards. Provide numbers, lettering and wording as approved in submittals as required by code or as recommended by the manufacturer.

### 2.2 RACEWAY AND CABLE LABELS

- A. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Subcontractor's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. ANSI Compliance: Conform to ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway or cable size.
  - a. Color: White legend on a black field.
  - b. Legend: Indicates voltage and source/service (and termination point for control cables).

- C. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl. Legend is laminated with a clear, weather- and chemical-resistant coating.
- D. Engraved Plastic-Laminated Nameplates: Provide nameplates for all new equipment to match existing nameplates at site.
- E. Pre-tensioned, Wrap-around Plastic Sleeves: Flexible, preprinted, color-coded, acrylic bands sized to suit the diameter of the line it identifies and arranged to stay in place by pre-tensioned gripping action when placed in position.
- F. Tape Labels: Embossed adhesive tape with 1/4 inch (minimum) white letters on a black background.
- G. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- H. Underground Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:
  1. Size: Not less than 6 inches wide by 4 mils thick.
  2. Compounded for permanent direct-burial service.
  3. Embedded continuous metallic strip or core.
  4. Printed Legend: Indicates type of underground line.
- I. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters for Designation purposes.
- J. Aluminum, Wraparound Marker Bands: Wrap-around bands cut from 0.014-inch-thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
  1. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, except as otherwise indicated, with eyelet for fastener.
- K. Copper, Brass or Aluminum Tags: Metal tags with stamped legend, punched for fastener. Dimensions: Tags shall be circular in shape, two inches minimum diameter, by 0.02 inch thick for copper or by 0.05 inch thick for brass or aluminum.

## 2.3 ENGRAVED NAMEPLATES AND SIGNS

- A. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Engraving stock: Melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 sq. in. or 8 inches in length; 1/8 inch thick for larger sizes. Minimum width of engraving stock shall be 2 times letter height.
- C. Engraved legend: Engraved three layer laminated plastic white letters on black background.
- D. Letter Height: Lettering for equipment identification shall be 3/8 inch high. Voltage rating and source lettering shall be 1/4 inch high.

- E. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched for mechanical fasteners, with colors, legend, and size as indicated or as otherwise required for the application. Use 1/4-inch grommets in corners for mounting.
- F. Wire and Cable Markers: Cloth markers, split sleeve or tube type.
- G. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, non-fading, preprinted, cellulose acetate butyrate signs with 0.0396-inch, galvanized steel backing, with colors, legend, and size appropriate to the application. Use 1/4-inch grommets in corners for mounting. Signs shall be punched for mechanical fasteners.
- H. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.
- I. Tape Labels: Embossed adhesive tape with 1/4 inch (minimum) white letters on a black background.

## 2.4 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties with the following features:
  1. Minimum Width: 3/16 inch.
  2. Tensile Strength: 50 lb minimum.
  3. Temperature Range: Minus 40 to 185 deg F.
- B. Paint: Alkyd-urethane enamel over primer as recommended by enamel manufacturer.

## PART-3 EXECUTION

### 3.1 INSTALLATION:

- A. Existing Nameplates: Install nameplates for all new equipment to match existing nameplates on site.
- B. Consistency: Use consistent designations throughout the Project
- C. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.
  1. Self-Adhesive Identification Products: Degrease and clean surfaces of dust, loose material, and oily films before applying.
- D. Raceway/Cable Identification of Special Systems: Identify raceways and exposed cables of special systems with color banding and black lettering appropriately sized for raceway. Band exposed, and accessible raceways of the systems listed below for identification.
  1. Bands: Pre-tensioned, snap-around, colored plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches wide, completely encircling raceway place adjacent bands of 2-color markings in contact, side by side. Locate bands

at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25 feet in congested areas.

E. Circuit Identification Labels on Boxes: Label externally as follows:

1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label, as well as “magic marker” on cover.
2. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.

F. Underground Utility Line Warning Tape: During trench backfilling, for exterior underground power, control, signal, and communications lines, install continuous underground plastic line marker with metallic tracer located directly above line at 6 to 8 inches below finished grade. Where multiple lines installed in a common trench or concrete envelope do not exceed an overall width of 16 inches, use a single line marker.

Install line marker for underground wiring, both direct buried and in raceway.

G. Color Code Conductors: The following field-applied color-coding methods may be used in lieu of factory-coded wire listed in part 2 of Section 26 05 19 LOW VOLTAGE WIRES AND CABLES for sizes larger than No. 4 AWG. Contractor shall demonstrate non-availability of factory colored wire before using this application

1. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply the last 2 turns of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as specified. Adjust tape bands to avoid obscuring cable identification markings.
  - a. Where conductors are color coded by this method, they shall be color coded in accessible raceways, panelboards, outlets, and switches, as well as at all terminations. Conductors in accessible raceways shall be color coded so that by removing or opening any cover, the coding will be visible.
2. Green insulated conductors shall not be re-identified for purposes other than grounding.
3. White or neutral gray conductors shall not be re-identified for purposes other than grounded neutrals.

H. Power Circuit Identification: Use metal tags or aluminum wraparound marker bands for cables, feeders, and power circuits in pull boxes, junction boxes, handholes, switchgear rooms, switchboard rooms, engine generator rooms, UPS rooms, and all electrical closets.

1. Legend: 1/4-inch letter and number, stamping or embossing, with legend corresponding to indicated circuit designations.
2. Fasten tags with cable ties; fasten bands using integral ears.

I. Conductor Identification for Other Systems:

1. Install cable tags in each handhole with not less than two tags per cable, one near each duct entrance hole.
2. Attach tags to cable immediately after installation.
3. Cable terminations shall be tagged as to function.

4. Attach securely to cable using 1/8 inch nylon cord.
- J. Signage: Install warning, caution, and instruction signs as follows:
3. Install signs where indicated or required to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved, plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing in outdoor locations.
- K. Identification Labels: Install identification labels as follows:
1. Apply equipment identification labels of engraved plastic laminate on each major unit of equipment, including central or master unit of each system. This includes communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. The first line shall show the equipment ID, the second line shall show the voltage and source.
  2. Apply labels for each unit of the following categories of equipment:
    - a. Panelboards, electrical cabinets, and enclosures
    - b. Access doors and panels for concealed electrical items
    - c. Transformers
    - d. Disconnect switches
    - e. Enclosed circuit breakers
  3. Apply identification labels of engraved plastic laminate for disconnect switches, enclosed breakers, and similar items for power distribution and control components above, except panelboards where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.
  4. Install labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
  5. Tag cables in each handhole with not less than two tags per cable, one near each duct entrance hole.
    - a. Attach tags to cable immediately after installation.
    - b. Cable terminations shall be tagged as to function.
    - c. Attach securely to cable using 1/8 inch nylon cord.
- L. Update all panelboards, new or existing, that have been modified by adding, removing, or relocating circuits. See panelboard schedule attached at the end of this section.

**END OF SECTION**

**SECTION 26 08 00.13**  
**TESTING AND INSPECTING ELECTRICAL EQUIPMENT**

**PART-1 GENERAL**

**1.1 DESCRIPTION**

Requirements of Conditions of the Contract, Division 1, Contract Drawings and other Specification Sections form a part of this Section.

- A. Work Included in This Section.
  - 1. Testing of all electrical equipment.
- B. Related Work Included in Other Divisions and Sections.
  - 1. Basic Electrical Materials and Methods, Section 26 05 00.

**1.2 REFERENCES**

The inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein.

- A. FAA Order: JO 6950.22A Maintenance of Electrical Power Cables
- B. FAA Order: JO 6000.204 Maintenance of National Airspace System (NAS) Telecommunications Services
- C. FAA Form 6030-17 Technical Reference Data Record
- D. National Electrical Code - NEC (NFPA 70).
- B. National Electrical Manufacturer's Association - NEMA.
- C. American Society for Testing and Materials - ASTM.
- D. Institute of Electrical and Electronic Engineers - IEEE.
- E. National Electrical Testing Association - NETA.
- F. American National Standards Institute - ANSI.
- G. State and Local Codes and Ordinances.
- H. Insulated Cable Engineers Association - ICEA.
- I. Illuminating Engineering Society - IES.
- J. OSHA Part 1910; Subpart S, 1910.308.
- K. National Fire Protection Association - NFPA.

**1.3 SUBMITTALS**

Parsons WRPM approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Prior to the Start of Work
  - a. Qualifications of Testing Service Company. The Owner reserves the right to disqualify any Test Service or testing personnel based upon qualification submitted.
  - b. Contractors Test and Report Forms.
- B. Upon completion of testing provide formal Test Report to include the following:
  - a. Summary of project.



- b. Description of equipment tested.
- c. Description of test.
- d. Test results.
  - i. The following is a list of reports and forms that the Subcontractor or the Testing Service shall use in reporting the results:
    - 1. Instrument Calibration Test and Data Sheet (2 sheets).
    - 2. Low Voltage Circuit Breaker Test Report.
    - 3. Insulation Resistance Test Report.
  - ii. Subcontractor may use its standard forms in place of the forms provided if they provide essentially the same information.
    - 1. Submit forms for approval.
  - iii. Where test forms are not provided Subcontractor may provide its own forms.
    - 1. Submit forms for approval.
- e. Conclusions and recommendations.
- f. Appendix, including appropriate completed test forms.
- g. List of test equipment used and calibration date.

#### 1.4 QUALIFICATIONS

- A. The Testing Service shall meet federal OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907.
- B. Testing Services shall submit proof of the above qualifications to the Engineer.
- C. Electrical service companies such as Westinghouse or General Electric are assumed qualified, but must submit a statement of qualification of testing personnel and work histories shall specifically include FAA NAVAIDs equipment start-up and testing.

#### 1.5 SYSTEM DESCRIPTION

- A. The Contractor shall engage the services of a recognized Testing Service for the purpose of performing inspections and tests for equipment safety and operability, and functionally verify the control system operates in accordance with the contract documents.
- B. The Testing Service shall provide all material, equipment, labor and technical supervision to perform such tests and inspections.
- C. The intent of these tests is to assure that all electrical equipment is operational within industry and manufacturer's tolerances and to functionally test all electromechanical systems.

- D. Upon completion of the tests and inspections noted in these Specifications, a label shall be attached to all devices tested. These labels will indicate date tested, initial of the technician who conducted the test and the service company responsible.
- E. The tests and inspections shall determine suitability for continuous reliable operation.
- F. The Subcontractor may submit another electrical equipment test procedure in lieu of this Section to the Contractor for approval.
- G. The Subcontractor and the Electrical Testing Service shall resolve any deficiencies and retest in a timely manner to facilitate the project start-up and commercial operation.
- H. The inspections and tests shall utilize the following references.
  - 1. Project design Specifications.
  - 2. Project design Drawings.
  - 3. Manufacturer's instruction manuals applicable to each particular apparatus.
  - 4. Contractor generated drawings and documents.
  - 5. Contract Drawings submitted by manufacturers and vendors.
- I. All instruments used to evaluate electrical performance shall meet Specifications for Test Instruments (refer to Part 2 of this Specification).
- J. Electrical performance tests shall include the following
  - 1. Control Panels
  - 2. Low voltage circuit breakers
  - 3. 600 volt feeder cables
  - 4. System functions tests
- K. The Subcontractor shall perform routine insulation resistance, continuity and rotation tests for all distribution and utilization equipment prior to and in addition to tests performed by the Testing Service specified herein.
- L. The Subcontractor shall notify the Contractor when equipment becomes available for electrical tests. Work shall be coordinated to expedite project scheduling.
- M. The Subcontractor shall supply a set of electrical plans, specifications and any pertinent change orders to the Testing Service prior to commencement of testing.
- N. The Subcontractor shall notify the Contractor prior to commencement of any testing.
- O. The Testing Service shall be responsible for implementing the final settings and adjustments on protective devices and electrical equipment in accordance with approved values.

- P. Set points shall be noted on all calibration stickers.
- Q. Any system material or workmanship, which is found defective on the basis of electrical tests shall be replaced and retested at no additional cost to the Contractor.
- R. The Testing Service shall maintain a written record of all tests and upon completion of the project, assemble and certify a final test report.

## PART-2 PRODUCTS

### 2.1 TEST INSTRUMENT TRACEABILITY

- A. The Testing Service shall have a calibration program, which maintains applicable test instrumentation within rated accuracy.
- B. The accuracy shall be traceable to the National Institute for Standards and Technology in an unbroken chain.
- C. Instruments shall be calibrated in accordance with the following frequency schedule:
  - 1. Field instruments - 6 months maximum.
  - 2. Laboratory instruments - 12 months.
  - 3. Leased specialty equipment - 12 months. (Where accuracy is guaranteed in writing by the lessor.)
- D. Dated calibration labels shall be visible on all test equipment.
- E. Records must be kept up to date which show date and results of all instruments calibrated or tested.
- F. An up-to-date instrument calibration instruction and procedure will be maintained for each test instrument.

## PART-3 EXECUTION

### 3.1 SAFETY AND PRECAUTIONS

- A. Safety practices shall include, but are not limited to, the following requirements:
  - 1. Occupational Safety and Health Act - OSHA.
  - 2. Accident Prevention Manual for Industrial Operations, Seventh Edition, National Safety Council, Chapter 4.
  - 3. Applicable State and local safety operating procedures.
  - 4. NETA Safety/Accident Prevention Program.
  - 5. National Fire Protection Association - NFPA 70 (NEC).
  - 6. National Fire Protection Association - National Electrical Safety Code.

- B. All tests shall be performed with apparatus de-energized except where otherwise specifically required herein.
- C. The Testing Service's lead test engineer for the project shall be a designated safety representative and shall be present on the project and supervise testing operations and safety requirements.
- D. Power circuits shall have conductors shorted to ground by a hotline grounding device approved for the purpose.
- E. In all cases, work shall proceed only when the safety representative has determined that it is safe to do so.
- F. The Testing Service shall have available sufficient protective barriers and warning signs to conduct specified tests safely, and shall post safety personnel as necessary while dangerous tests are being performed.
- G. The Contractor's safety procedures shall be reviewed and understood by the Subcontractors and Testing Service personnel.

### 3.2 SPECIAL REQUIREMENTS

Testing of the equipment associated with the interconnection to the local utility is required to be tested in strict accordance with the methods and procedures of the "Power Producers Interconnection Handbook."

- A. Where the methods or procedures required under this Section are in conflict with the "Power Producers Interconnection Handbook" the requirements of the "Power Producers Interconnection Handbook" shall govern.
- B. The Testing Service is responsible for
  - 1. Obtaining the latest edition of the "Power Producers Interconnection Handbook."
  - 2. Coordinating with the local utility in the performance of the required tests.

### 3.3 TEST PROCEDURES

- A. Protective Relays
  - 1. Visual and Mechanical Inspection
    - a. Relays shall be inspected for physical damage and compliance with specifications.
    - b. Inspect cover gasket, cover glass, presence of foreign material, moisture, condition of spiral spring, disc clearance, rust and contacts.
    - c. Check mechanically for freedom of movement, proper travel and alignment, and tightness of mounting hardware and tap screws.
    - d. All settings shall be made in accordance with the approved settings.
  - 2. Electrical Tests

- a. Perform insulation resistance test on each circuit branch to frame. Do not perform this test on solid state relays.
- b. Perform the following tests on the nominal settings specified by the coordination study:
  - 1) Pickup parameters on each operating element.
  - 2) Timing test shall be performed at three (3) points on time dial curve.
  - 3) Pickup target and seal in units.
  - 4) Special test as required to check operation of restraint, directional and other elements per manufacturer's instruction manual.
  - 5) Perform phase angle and magnitude contribution tests on all differential and directional type relays after energization to vectorially prove proper polarity and connection.

## B. Metering and Instrumentation

1. Visual and Mechanical Inspection
  - a. Examine all devices for broken parts, indication of shipping damage and wire connection tightness.
  - b. Verify meter connections in accordance with single line meter and relay diagram.
2. Electrical Tests
  - a. Calibrate all meters at mid-scale. Calibration instruments shall have precision no more than fifty percent (50%) of the instrument being tested.
  - b. Calibrate watt-hour meters to one-half percent (1/2%).
  - c. Verify all instrument multipliers.

## C. Circuit Breakers - Low Voltage

1. Visual and Mechanical Inspection
  - a. Inspect for physical damage and nameplate compliance with single line diagram.
  - b. Mechanical operational tests shall be made in accordance with manufacturer's instruction manual.
  - c. Cell fit and element alignment shall be checked.
  - d. Check tightness of connections.
2. Electrical Tests
  - a. A contact resistance test shall be performed.
  - b. An insulation resistance test shall be performed at 1,000 volts DC for one (1) minute from pole to pole and from each pole to ground and across open contacts of each phase.
  - c. Minimum pickup current shall be determined by primary current injection.
  - d. Long time delay shall be determined by primary injection at three hundred percent (300%) pickup current.
  - e. Short time pickup and time delay shall be determined by primary injection of current.
  - f. Instantaneous pickup current shall be determined by primary injection.
  - g. Trip unit reset characteristics shall be verified.

- h. Adjustments shall be made for final settings in accordance with prescribed settings.
  - i. Auxiliary protective devices, such as ground fault or under-voltage shunt trip devices.
3. Test Values
- a. Contact resistance shall be determined in micro-ohms. values exceeding two hundred (200) micro-ohms or any values which deviate from adjacent poles or similar breakers by more than fifty percent (50%) should be investigated.
  - b. Insulation resistance shall not be less than fifty (50) mega-ohms.
  - c. Minimum pickup current, trip times and instantaneous pickup values shall be adjusted to approved settings. Test values should fall within manufacturer's published time-current characteristic tolerance band.
- D. Cables - Low Voltage (600 Volt Feeders)
- 1. Visual and Mechanical Inspections
    - a. Inspect exposed section for physical damage.
    - b. Verify cable is supplied and connected in accordance with single line diagram.
    - c. Inspect for cable support and termination.
    - d. Visible cable bends shall be checked against ICEA or manufacturer's minimum allowable bending radius.
  - 2. Electrical Tests
    - a. Dielectric absorption ("megger") test.
      - 1) Tests shall be phase-to-phase and phase-to-ground.
      - 2) Test for 5 minutes at voltage given in Table 2.
  - 3. Test Values
    - a. Dielectric absorption test results.
      - 1) Minimum acceptable values of insulation resistance shall be as recommended by the cable manufacturer.
      - 2) Test should show no evidence of cable damage.
- E. Instrument Transformers
- 1. Visual and Mechanical Inspection
    - a. Inspect for physical damage and compliance with design drawings.
    - b. Check mechanical clearances and proper operations of all disconnecting and grounding devices associated with potential transformers.
    - c. Verify proper operation of grounding or shorting devices.
  - 2. Electrical Tests
    - a. Confirm transformer polarity electrically.
    - b. Verify connection at secondary CT leads by driving a low current through the leads and checking for this current at applicable devices.
    - c. Confirm transformer ratio.
    - d. Measure insulation resistance of transformer secondary and leads with five hundred (500) volt mega-ohm meter.

- e. Measure transformer primary insulation with applicable over-potential tests.
- f. Verify connection of secondary PT leads by applying a low voltage to the leads and checking for this voltage at applicable devices.
- g. Check for PT secondary load with secondary voltage and current measurements. Make sure load is less than VA of PT.

3.4 TABLES

**TABLE -1**  
**US Standard**  
**BOLT TORQUE'S FOR BUS CONNECTIONS**

Heat Treated Steel

Grade	SAE 1 & 2	SAE 5	SAE 6	SAE 8
<b>Minimum Tensile (PSI)</b>	64K	105K	133K	150K
Bolt Diameter	Torque (Foot Pounds)			
1/4	5	7	10	10.5
5/16	9	14	19	22
3/8	15	25	34	37
7/16	24	40	55	60
1/2	37	60	85	92
9/16	53	88	120	132
5/8	74	120	167	180
3/4	120	200	280	296
7/8	190	302	440	473
1.0	282	466	660	714

Note: Reduce torque by 20% when Cadmium plated bolts are used.

\*\*Aluminum alloy bolts shall have a Minimum tensile strength of 55,000 pounds per square inch.

Silicon Bronze Fasteners\*

Bolt Diameter	Torque (Foot Pounds)	
	Non-Lubricated	Lubricated
5/16	15	10
3/8	20	14
1/2	40	25
5/8	55	40
3/4	70	60

Aluminum Alloy Fasteners\*\*

Bolt Diameter	Torque (Foot Pounds) Lubricated
5/16	8.0
3/8	11.2
1/2	20.0
5/8	32.0
3/4	48.0

\* Bronze alloy bolts shall have a minimum tensile strength of 70,000 pounds per square inch.



**TABLE - 2**  
**INSULATION RESISTANCE TEST VOLTAGE**

<b>Maximum Voltage Rating of Equipment</b>	<b>Minimum Test Voltage, DC</b>	<b>Minimum Insulation Resistance in Mega-ohms</b>
250	500	25
600	1,000	100
5,000	2,500	1,000
8,000	2,500	2,000
15,000	2,500	5,000

Values of insulation resistance less than manufacturer's minimum or kV + 1 in Mega ohms should be investigated. Overpotential tests should not proceed until insulation resistance levels are raised to said minimum.

**TABLE - 3**  
**AC/DC OVERPOTENTIAL TEST VOLTAGES**

<b><u>Rated kV</u></b>	<b><u>AC Test Voltage (kV)</u></b>	<b><u>DC Test Voltage (kV)</u></b>
15	27.0	37.5
69	115.0	Consult Manufacturer

**TABLE - 4**  
**INSULATION RESISTANCE CONVERSION FACTORS**  
**FOR CONVERSION OF TEST TEMPERATURE TO 20°C**

<u>TEMPERATURE</u>		<u>TRANSFORMER</u>	
<u>°C</u>	<u>°F</u>	<u>OIL</u>	<u>DRY</u>
0	32	.25	.40
5	41	.36	.45
10	50	.50	.50
15	59	.75	.75
20	68	1.00	1.00
25	77	1.40	1.30
30	86	1.98	1.60
35	95	2.80	2.05
40	104	3.95	2.50
45	113	5.60	3.25
50	122	7.85	4.00
55	131	11.20	5.20
60	140	15.85	6.40
65	149	22.40	8.70
70	158	31.75	10.00
75	167	44.70	13.00
80	176	63.50	16.00

**TABLE 5**  
**HIGH VOLTAGE TEST**  
**FOR RUBBER - THERMOPLASTIC - XLPE - EPR INSULATIONS**

Rated circuit Phase to Phase, Volts	Conductor Size AWG or KCMIL	Test Voltage, kV	
		100 Percent Insulation Level	133 Percent Insulation Level
2,001-5,000	8-1,000	25	25
5,001-8,000	6-1,000	35	35
8,001-15,000	2-1,000	55	65

**TEST MAXIMUM DC VOLTAGE REFERENCES**

Cable Type	Standard	
Rubber	ICEA S-19-81	Table 6-17
Varnish Cambric	ICEA S-65-375	Table 3-4*
Thermoplastic	ICEA S-61-402	Table 6-10
Cross Linked Polyethylene	ICEA S-66-524	Table 6-9
Ethylene Propylene (EPR)	ICEA S-68-516	Table 6-9
Armored Cable	ICEA S-67-401	80% of factory

\* For DC tests multiply table values by 2.

\*\* Consult manufacturer.

**END OF SECTION**

**SECTION 26 09 23**  
**LIGHTING CONTROL DEVICES**

**PART-1 GENERAL**

**1.1 SUMMARY**

**A. This Section Includes:**

1. Time switches.
2. Photoelectric switches.
3. Occupancy sensors.

**B. Related Requirements:**

Section 26 27 26 "Wiring Devices" for wall-box dimmers, wall-switch occupancy

**1.2 REFERENCE STANDARDS**

**1.3 SUBMITTALS**

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Product data for each type of product.

**PART-2 PRODUCTS**

**2.1 TIMER SWITCHES**

- A. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Contact Configuration: SPST.
3. Contact Rating: 30 amps inductive or resistive, 240-V AC. Substitutes:
4. Programs: Two on-off set points on a 24-hour schedule, allowing different set points for each day of the week.
5. Programs: 4 channels; each channel is individually programmable with eight on-off set points on a 24-hour schedule.
6. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
7. Astronomic Time: All channels.
8. Automatic daylight savings time changeover.
9. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock

## 2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Description: Solid state, with SPST dry contacts rated for 1800 VA, to operate connected load, complying with UL 773.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range.
  3. Time Delay: Thirty-second minimum, to prevent false operation.
  4. Lightning Arrester: Air-gap type.
  5. Mounting: Twist lock complying with NEMA C136.10, with base.

## 2.3 INDOOR OCCUPANCY SENSORS

- A. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors line voltage 120V or to be provide with a separate power pack.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A.
  6. Sensor is 120V rated. High bay sensors are powered from power pack.
  4. Power Pack: Dry contacts rated for 20-A load at 120V AC, Class 2 power source, as defined by NFPA 70.
  5. Mounting:
    - i. Sensor: Suitable for mounting in any position on a standard outlet box.
    - ii. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    - iii. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
  6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
  7. Bypass Switch: Override the "on" function in case of sensor failure.
  8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.

## 2.4 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
  3. Switch Rating: Not less than 800-VA at 120 :
    - i. Sensor: Suitable for mounting in any position on a standard outlet box.
    - ii. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    - iii. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
- B. Wall-Switch Sensor
1. Standard Range: 210-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft.
  2. Sensing Technology: Dual-Technology
  3. Switch Type: SP, field selectable automatic "on," or manual "on" automatic "off."
  4. Voltage: Match the circuit voltage.
  5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
  6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
  7. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
  8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

## PART-3 EXECUTION

### 3.1 INSTALLATION

- A. Installing: A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- B. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

- C. Mounting: Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.
- D. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- E. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

### 3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Lighting control devices will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

**END OF SECTION**

## SECTION 26 24 16 PANELBOARDS

### PART-1 GENERAL

#### 1.1 SUMMARY

This Section includes furnishing materials, equipment, labor, and incidentals necessary to install lighting, power and distribution panelboards and associated auxiliary equipment rated 600 V and less.

#### 1.2 REFERENCE STANDARDS

Applicable only to the extent specified.

- A. Federal Aviation Administration (FAA)
  - 1. FAA-C-1217G Electrical Work, Interior
  - 2. FAA-STD-019f Lightning and Surge Protection, Grounding, Bonding, and Shielding Requirements for Facilities and Electronic Equipment
- B. Federal Specification (FS)
  - 1. W-P-115 Panel, Power Distribution
  - 2. W-C-375 Circuit Breaker, Molded Case Branch Circuit and Service
- C. Institute of Electrical and Electronic Engineers (IEEE)
  - 1. C62.41 Recommended Practice on Surge Voltage in Low-Voltage AC Power Circuits
- D. National Electrical Manufacturers Association (NEMA)
  - 1. 250 Enclosures for Electrical Equipment (1000 Volts or Less)
  - 2. PB1 Panel Boards
  - 3. PB-1.1 Instructions for Safe Installation, Operation and Maintenance of Panelboards
  - 4. PB-1.2 Application Guide for Ground-Fault Protective Devices and Equipment
  - 5. AB1 Molded Case Circuit Breakers and Molded Case Switches
- E. International Electrical Testing Association (NETA)
  - 1. ATS Acceptance Testing Specification for Electric Power Distribution Equipment and Systems
- F. National Fire Protection Association (NFPA)
  - 1. NFPA 70 National Electric Code (NEC), latest edition
- G. Occupational Safety and Health Administration (OSHA)
  - 1. 29CFR1910.7 Definitions and Requirements for a Nationally Recognized Testing Laboratory (NTRL)
- H. Underwriters Laboratories (UL)
  - 1. 50 Electrical Cabinets and Boxes
  - 2. 67 Panelboards
  - 3. 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors
  - 4. 489 Molded Case Circuit Breakers and Circuit Breaker Enclosures



### 1.3 SUBMITTALS

- A. Product Data: For each type of panelboard, circuit breaker, accessory item and component specified, include outline and support point dimensions, voltage, circuit breaker data arrangement and size.
- B. Shop Drawings: For panelboards, include dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, voltage, and current rating. Include the following:
  - 1. Enclosure type with details for types other than NEMA 250, Type 1
  - 2. Bus configuration and current ratings
  - 3. Short-circuit current rating of panelboard
  - 4. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Include certified infrared scanning reports.
- E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- F. Maintenance Data: For panelboard components included in the maintenance manuals specified in Section 26 05 00.10 BASIC ELECTRICAL MATERIALS AND METHODS. Include manufacturer's written instructions for testing circuit breakers.

### 1.4 QUALITY CONTROL

- A. Testing Agency Qualifications: Independent testing agency shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1910.7, or shall be a full member company of NRTL.
  - 1. Testing Agency's Field Supervision: Person currently certified by the International Electrical Testing Association or National Institute for Certification in Engineering Technologies, to supervise on-site testing specified in Part 3 of this section.
- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
  - 1. The Terms "Listed" and "Labeled:" As defined in the National Electrical Code, Article 100.
  - 2. Listing and Labeling Agency Qualifications: A NRTL as defined in OSHA Regulation 1910.7.
- C. NFPA Compliance: Comply with NFPA 70, "National Electrical Code," latest edition.
- D. NEMA Compliance: Comply with NEMA PB 1, "Panelboards."
- E. Single Source Responsibility: Panelboards and circuit breakers located in the panelboards shall be the product of a single manufacturer.

### 1.5 EXTRA MATERIALS

Keys: Furnish two (2) keys to FAA for each panelboard installed.

## PART-2 PRODUCTS

### 2.1 GENERAL

Materials procured in this Section shall be in accordance with FAA-C-1217G, and FAA-STD-019f.

### 2.2 PANELBOARD FABRICATION

- A.** Panelboard Type: Panelboards shall be of box dead-front type with circuit breaker equipped and shall conform to Federal Specification W-P-115, Type I, Class 1 and shall also be listed by UL except for installations which require special panelboards to incorporate items not available as UL listed.
- B.** Enclosures: UL 50, general purpose, galvanized sheet steel, surface-mounted cabinets with baked-on gray enamel over a rust inhibitor as indicated on the drawings. Panelboards shall be listed and labeled by Underwriters Laboratories, Inc. in accordance with UL Standard 67, and shall conform to the latest requirements of the National Electric Code latest edition, and of NEMA Standard PB 1, Type 1, Class 1, unless otherwise indicated to meet environmental conditions at installed locations.
- C.** Directory Frame: Metal, mounted inside each panelboard door.
- D.** Main Bus: Hard drawn copper of 98 percent conductivity meet UL 67 temperature rise limits, and have a current density of 1000 amperes per square inch. Bus bars shall be sequenced-phased, and rigidly supported by high impact resistant, insulated bus supporting assemblies to prevent vibration or short circuits. Solderless terminations shall be suitable for copper UL listed wire or cable and shall be tested and listed in conjunction with appropriate UL standards.
1. Bus capacity as indicated on Contract Drawings, or equal to or greater than the panelboard overcurrent protection device.
  2. Bus bars connections to bolt on branch circuit breakers shall be of the sequence phase type.
  3. Where provisions for “future” or “space” are noted on the drawings the panelboard shall be equipped with bus connections for the future installation of circuit breakers.
  4. Sequence style busing to accept bolt on molded case circuit breakers.
- E.** Neutral Bus:
1. The neutral bar shall be fully rated and capable of being located in either corner of the enclosure at the line ends to facilitate conductor termination and shall be insulated from panelboard.
  2. Neutral bus bar shall be copper or plated copper, and insulated from panelboard.
  3. The neutral bus shall be isolated from all other busses except where the panelboard is used as the service disconnecting means.
- F.** Equipment Ground Bus: Ground bus shall be copper, and adequate for feeder and branch-circuit equipment ground conductors with 25% additional space for future connections. Lugs shall be sized to accommodate grounding conductors shown on Contract Drawings.
1. The ground bus shall be securely bonded to the cabinet and shall be separate from the neutral bus.
  2. The number of lug terminations shall be at least equal to the number of poles in the panelboard.
  3. The ground bus bar shall be structurally integral to the panelboard, or attached to the panelboard with a bolt, nut, and lock washer.

- a. Bond conductor shall have same current carrying capacity as the largest equipment grounding conductor terminated to the ground bus bar.
- G. Short circuit rating: Panelboards shall be fully rated for short circuit. See Contract Drawings for short circuit rating.
- H. Future Devices: Equip phase busses with mounting brackets, bus connections, and necessary appurtenances, for the overcurrent protective device ampere ratings indicated for future installation of devices.
- I. Panelboard Features: Include the following special features for panelboards.
  1. Hinged Front Door in Door Construction: Entire front trim hinged to box with standard door within hinged trim cover (one-piece front with two doors). The smaller door, when open, provides access to device handles and rating labels and shall be lockable. The larger door, when open, provides access to conductors and wiring terminals. Door hinges shall be continuous piano hinges that are welded to the door(s) and bolt on front. All door hinges shall be concealed.
  2. Channel/Wiring Space: Shall be four inches wide for power feeders up to and including 100 amperes, six inches wide for power feeders over 100 amperes and up to and including 225 amperes, and eight inches wide for power feeders over 225 amperes and up to 600 amperes.
  3. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and floor.
  4. Subfeed: Overcurrent protective device or lug provision as shown on Contract Drawings.
  5. Doors shall have flush type cylinder locks and catches. All locks in a project shall be keyed alike, and 2 keys shall be furnished with each lock.
- J. Wire Gutter Size: The minimum size of the side wiring gutters shall be 4 inches for power feeders up to and including 100 Amperes, 6 inches for power feeders over 100 Amperes and up to 225 Amperes and 8 inches for panelboards over 225 Amperes up to 600 Amperes.

### 2.3 OVER-CURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker: NEMA AB 1, UL 489, FS W-C-375, and the following requirements:
  1. Circuit breaker shall be molded case type.
  2. Circuit breaker shall be bolt-on type. Stab-in and plug-in types are not acceptable.
  3. Quick make, quick break connections with mechanical trip, free switching mechanism.
  4. Inverse time, thermal trip for overloads. Automatic release secured by bi-metallic thermal element releasing the mechanism latch. Thermal trip calibrated for 40 degree C ambient temperature.
  5. Instantaneous magnetic trip armature for short circuits.
  6. Multiple circuit breakers shall have an internal, common trip mechanism to open all poles simultaneously.
  7. Automatic trip indication as a color change in the trip indicator window and by a handle position between the manual "OFF" and "ON" positions.
  8. Single-pole breakers shall be full size modules. Half sized breakers shall not be allowed.
  9. Two and three pole breakers shall be sized in multiples of a single-pole breaker;

10. Branch circuits shall be connected to the circuit numbers as indicated on Contract Drawings.
  11. UL marked as suitable for use with 75 deg C wire.
  12. Series ratings of breakers shall not be permitted.
- B.** Characteristics: Provide frame size, trip rating, number of poles, auxiliary devices, voltage rating and interrupting capacity rating to meet available fault current as indicated on Contract Drawings.
1. Minimum interrupting rating: 10,000 AIC.
  2. Where the panelboard interrupting capacity is not indicated on the Contract Drawings, the circuit breaker interrupting capacity shall be equal to or greater than the available fault current at the panelboard.
- C.** Circuit Breakers, 200 A and Larger: Provide trip units interchangeable within frame size.
- D.** Lugs: Provide mechanical lugs and power-distribution connectors for number per phase, size, and material of conductors indicated on Contract Drawings.
- E.** Single Manufacturer: All circuit breakers and the panelboard in which the breakers are installed shall be products of the same manufacturer.
- F.** Mains: Panelboards shall have either main lugs or main circuit protective device as scheduled.
- G.** Replacement: Provide bolt-on circuit breakers, replaceable without disturbing adjacent units.
1. Branch circuits shall be connected to the individual circuit breakers as indicated on contract drawings.

## 2.4 ACCESSORY COMPONENTS AND FEATURES

Accessory Set: Include tools and miscellaneous items as required for overcurrent protective device test, inspection, maintenance, and operation.

## PART-3 EXECUTION

### 3.1 GENERAL

Comply with manufacturer's requirements in accordance with the direction of the WRPM.

### 3.2 INSTALLATION

- A.** Materials: Materials procured and installed in this Section shall be in accordance with FAA-C-1217G, and FAA-STD-019f.
- B.** Mounting Heights: Install panelboards and accessory items according to NEMA PB 1.1 and with applicable codes at each location indicated on the plan. Mount the top of the panelboard trim at 78 inches from the ground, unless otherwise indicated.
- C.** Mounting Tall Panelboards: Panelboards greater than 90 inches tall shall be mounted directly on the floor or maintenance pad, as shown on Contract Drawings.
- D.** Mounting: Plumb and rigid without distortion of box. Mount flush panelboards uniformly flush with wall finish.
- E.** Circuit Directory: Type directory to include installed circuit loads after balancing panelboard loads. The directory shall be arranged so that typed entries simulate circuit breaker positions in the

panelboard. The directory shall be mounted on the inside of the door in a holder with a protective covering. Obtain approval from the WRPM before installing.

- F. Filler Plates: Provide and install filler plates for unused spaces in panelboards.
- G. Wiring in Panelboard Gutters: Arrange conductors into groups, and bundle with wire ties after completing load balancing.

### 3.3 IDENTIFICATION

- A. Component Identification: Identify field-installed wiring as specified in Section 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS.
- B. Panelboard Nameplates: Label each panelboard with engraved laminated-plastic or metal nameplates mounted with corrosion-resistant screws, as specified in Section 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS.
- C. Warning Signs: Provide warning signs as specified in Section 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS.

### 3.4 GROUNDING:

- A. Termination: Terminate ground connections in panelboards in accordance with Section 25 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- B. Tightening Torque: Tighten electrical connectors and terminals, including ground connections, according to the manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A.
- C. Ground Bus Bar: If ground bus bar is mounted to enclosure with screw threads only, (i.e. tapped blind hole), a separate bolted ground lug shall be installed on the panelboard and bonded to the ground bus bar.

### 3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  1. Measure and record steady-state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 10 percent, rearrange circuits on the panelboards to balance the phase loads within 10 percent.
  2. Take care to maintain proper phasing for multi-wire branch circuits.
  3. Perform insulation-resistance megger tests of each panelboard bus, component, and connecting supply, feeder, and control circuits to main service ground.
  4. Make continuity and phasing tests of each circuit.
  5. Perform ground continuity tests on main electrical ground bus to inspect for physical damage, proper alignment, anchorage, and grounding.
  6. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.
- B. After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA, ATS, Section 7.5 for switches, and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
  2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.
  3. Check each panelboard to insure that it contains a minimum of 20 percent spare capacity for future use.
- C. 3.6 Adjusting: Set field-adjustable switches and circuit breaker trip ranges as indicated.
- D. Cleaning: On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt and debris. Touch up scratches and marred finishes to match original finish.

**END OF SECTION**

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 26 27 26**  
**LOW VOLTAGE WIRING DEVICES**

**PART-1 GENERAL**

**1.1 SUMMARY**

- A. This Section includes various types of receptacles, multi-outlet assemblies, lighting switches, and finish plates.
- B. Subcontractor shall furnish and completely install lighting switches, convenience and multi-outlet assemblies, special purpose receptacles, etc., along with appropriate outlet boxes, trim and finish plates, etc., as indicated on the drawings and schedules and as herein specified.
- C. Where connection to an item of equipment is required under this contract, and where such equipment requires a wiring device (special purpose receptacle) for connection, Subcontractor shall furnish and install the appropriate device, whether or not the device is specifically shown or specified.

**1.2 REFERENCE STANDARDS**

Applicable only to the extent specified.

- A. Federal Aviation Administration (FAA)
  - 1. FAA-C-1217G Electrical Work, Interior
  - 2. FAA-STD-019f Lightning and Surge Protection, Grounding, Bonding, and Shielding Requirements for Facilities and Electronic Equipment
- B. Federal Specifications (FS)
  - 1. W-C-596 General and Associated Detailed Specifications: Connector, Plug Receptacle, and Cable Outlet, Electrical Power
  - 2. W-S-896E Switch, Toggle, Flush Mounted
- C. National Electrical Manufacturer Association (NEMA)
  - 1. WD1 General Requirements for Wiring Devices
- D. National Fire Protection Association (NFPA)
  - 1. 70 National Electrical Code (NEC), latest edition
- E. Occupational Safety and Health Administration (OSHA)
  - 1. 29 CFR1910.7 Definitions and Requirements for a Nationally Recognized Testing Laboratory (NRTL)
- F. Underwriters Laboratories (UL)
  - 1. 20 General Use Snap Switches
  - 2. 498 Electrical Attachment Plugs and Receptacles
  - 3. 943 Ground Fault Circuit Interrupters

**1.3 SUBMITTALS**

Parsons WRPM approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Provide Component catalog numbers and manufacturer's data sheets, including pertinent data identifying each component by the item number and nomenclature, as specified.
- B. Operation and maintenance data for materials and products specified in this Section to be included in Section 26 05 00.10 BASIC ELECTRICAL MATERIALS AND METHODS.

**1.4 QUALITY CONTROL**

- A. Comply with NFPA 70, NEC, latest edition, for devices and installation.



- B. Listing and Labeling: Provide products that are listed and labeled for their applications and installation conditions and for the environments in which installed.
  1. The Terms "Listed" and "Labeled": As defined in the NEC," Article 100.
  2. Listing and Labeling Agency Qualifications: A NRTL as defined in OSHA Regulation 1910.7
- C. The manufacturer shall be a company specializing in the manufacturing products specified in this Section with a minimum of five (5) years experience.

#### 1.5 COORDINATION:

- A. Wiring Devices for Government Furnished Equipment: Match devices to plug connectors for Government-furnished equipment.
- B. Device plates shall be stainless steel, brushed finish. Convenience receptacles shall be brown; computer receptacles shall be ivory; and receptacles for critical circuits shall be red in color.

### PART-2 PRODUCTS

#### 2.1 GENERAL:

- A. Materials procured and installed in this Section shall be in accordance with:
  - a. FAA-C-1217G
  - b. FAA-STD-019f
- B. All wiring devices of any one general type (e.g. all duplex receptacles, all wall switches etc.) shall be of the same manufacturer and shall match throughout.

#### 2.2 WIRING DEVICES

- A. Comply with NEMA Standard WD 1, "General Purpose Wiring Devices," and UL approved, specification grade.
- B. Enclosures: NEMA 1 equivalent, except as otherwise indicated. Exterior receptacles shall be mounted in waterproof cast outlet boxes with waterproof covers.
- C. Receptacles, General: All receptacles shall be specification grade in accordance with NEMA WD 1. Wiring terminals shall be of the screw-type. Receptacles with push-in connections or a combination of screw-type and push-in connectors are not acceptable.
- D. Straight-Blade: Except as otherwise indicated, comply with Federal Specification W-C-596 and heavy-duty grade of UL Standard 498, "Electrical Attachment Plugs and Receptacles." Provide NRTL labeling of devices to verify these compliances.
- E. General Purpose Duplex Receptacle: 125 volt, 20 Ampere, 2 pole, 3 wire grounded, with polarized slots, NEMA 5-20R.
- F. Receptacles, Straight-Blade, Special Features: Comply with the basic requirements specified above for straight-blade receptacles of the class and type indicated, and with the following additional requirements:
- G. Ground-Fault Circuit Interrupter Receptacles: UL Standard 943, "Ground Fault Circuit Interrupters," feed-through type, with integral NEMA 5-20R (UL Group I, Class A), duplex receptacle arranged to protect connected downstream receptacles on the same circuit. Contact arrangement shall be such that contact is made on two sides of an inserted blade. Receptacle shall be side or back wired with two screws per terminal. The grounding screw shall be connected to the metal mounting yoke.
- H. Weatherproof Receptacles shall be mounted in a box with a gasketed cover.
- I. Special Purpose or Heavy Duty Receptacles: Shall be of the type, rating and number of poles indicated or required for the anticipated purpose. Contact surfaces may be either round or rectangular. One appropriate straight or angle type plug of the same configuration shall be furnished with each receptacle.

- J. Wall Switches: Snap Switches: AC switches, NRTL listed and labeled as complying with UL Standard 20 “General Use Snap Switches”, and with Federal Specification W-S-896E.
- K. Single-pole and three way wall switches shall be specification grade, 120/277 volts, and shall be fully rated 20 amperes AC only, totally enclosed toggle type with bodies of phenolic compound.
- L. Wire terminals shall be of the screw type.
- M. Switches with push-in connections or a combination of screw type and push-in connectors are not acceptable.
- N. Switches shall be the quiet-operating type.
- O. Switch handles shall be ivory in color.
- P. Devices and Devices Plates:
- Q. Provide device plates of one-piece type to suit the devices installed.
  - i. Plate screw shall be metal with countersunk head, in a color to match the finish of the plate.
  - ii. Provide device plates as follows:
    - 1. Brushed stainless steel in unfinished areas (e.g. ALSF Shelter).
    - 2. Gasketed in wet locations.
  - iii. Intercommunications outlets shall be provided with a blank cover plate unless otherwise indicated.

## PART-3 EXECUTION

### 3.1 INSTALLATION

- A. Arrangement of Devices: Except as otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on bottom. Group adjacent switches under single, multi-gang wall plates.
- B. Where two or more devices indicated for gang installation, they shall be trimmed with gang type plates. Sectional Plates are not acceptable.
- C. Install devices and assemblies tightly to boxes and adjusted plumb, level.
- D. Receptacles shall be installed 18 inches above finished floor, unless noted otherwise.
- E. Wall switches shall be installed 48 inches above finished floor, unless noted otherwise.
- F. Install receptacles with grounding pole on the bottom.
- G. Wall Switch Installation:
  - 1. Not more than one switch shall be installed in a single gang position.
  - 2. Grounding: Where switches have grounding terminals, they shall be grounded with a green grounding pigtail connected from the switch grounding screw directly to the grounding lug on the outlet box where the green equipment grounding conductor is terminated.
  - 3. Install switches with “Off” position down.
- H. Device Plate Installation :
  - 1. Plates shall be installed with all four edges in continuous contact with finished wall surfaces without use of mats or similar devices.
  - 2. Plates installed in wet locations shall be gasketed.
  - 3. Use of sectional type device plates shall not be permitted.
  - 4. Plastic rings shall not be permitted.
  - 3. Install wall plates after painting is complete.
- I. Protect devices and assemblies during painting.
- J. Install products in accordance with the manufacturer’s instructions.

### 3.2 IDENTIFICATION

Comply with Section 26 05 53 IDENTIFICATION OF ELECTRICAL SYSTEMS.

### 3.3 GROUNDING

The green insulated equipment grounding conductor, run with the power conductors, shall terminate at the device yoke grounding screw. In addition to this ground connection, install a 12 AWG jumper from the device yoke grounding screw to device box grounding lug screw.

### 3.4 FIELD QUALITY CONTROL:

- A. Testing: Test wiring devices for proper polarity, continuity and operation.
- B. Test ground-fault circuit interrupter operation with both local and remote fault simulations according to manufacturer's recommendations.
- C. Test that each switch operates properly 6 times in succession.
- D. Verify that each receptacle device is energized.
- E. Replace damaged or defective components.

### 3.5 CLEANING

General: Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

**END OF SECTION**

THIS PAGE INTENTIONALLY LEFT BLANK

**SECTION 26 28 00**  
**ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

**PART-1 GENERAL**

**1.1 SUMMARY**

This Section includes furnishing materials, equipment, labor, and incidentals necessary to install individually mounted disconnect switches and circuit breakers used for the following:

1. Feeder and equipment disconnect switches
2. Feeder overcurrent protection
3. Service

**1.2 REFERENCE STANDARDS**

Applicable only to the extent specified.

- A. Federal Aviation Administration
  - a. FAA-C-1217G Electrical Work, Interior
  - b. FAA-STD-019f Lightning and Surge Protection, Grounding, Bonding, and Shielding Requirements for Facilities and Electronic Equipment
- B. Federal Specifications
  - a. W-C-375 Circuit Breakers, Molded Case, Branch Circuit and Service
  - b. W-S-865 Safety Switches
- C. International Electrical Testing Association (NETA)
  - a. ATS Acceptance Testing Specification for Electric Power Distribution Equipment and Systems
- D. National Electrical Manufacturer Association (NEMA)
  - a. KS 1 Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
  - b. FU 1 Low Voltage Cartridge Fuses
  - d. PB 1.2 Application for Ground Fault Protective Devices and Equipment
- E. National Fire Protection Association (NFPA)
  - a. National Electrical Code (NEC), latest edition
- F. Occupational Safety and Health Administration (OSHA)
  - a. 29CFR1910.7 Definitions and requirements for a Nationally Recognized Testing Laboratory (NRTL)
- G. Underwriters Laboratories (UL)
  - a. 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors

**1.3 SUBMITTALS**

Parsons WRPM approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Product Data for switches, circuit breakers and accessories specified in this Section. Include the following:
  - a. Voltage rating
  - b. Current trip rating
  - c. Short circuit rating
  - d. Fuse rating
  - e. Type of enclosure
  - f. Circuit frame size, trip rating, and number of poles
- B. Field test reports indicating and interpreting test results.
- C. Include outline drawings with dimensions and equipment ratings for voltage, capacity and short circuit.

#### 1.4 QUALITY CONTROL:

- A. Single Source Responsibility: Obtain disconnect switches and circuit breakers from one source and by a single manufacturer.
- B. NFPA Compliance: Comply with NFPA 70 latest edition for components and installation.
- C. Listing and Labeling: Provide disconnect switches and circuit breakers specified in this Section that are listed and labeled.
  - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
  - 2. Listing and Labeling Agency Qualifications: A NRTL as defined in OSHA Regulation 1910.7.

## PART-2 PRODUCTS

### 2.1 GENERAL

Materials procured and installed in this Section shall be in accordance with FAA-C-1217G, and FAA-STD-019f.

### 2.2 FUSES

Refer to Section 26 28 13 FUSES for fuse requirements.

### 2.3 DISCONNECT SWITCHES

- A. General: Switches shall be heavy duty, fusible or non-fusible of the voltage, phase, and current ratings indicated on the Contract Drawings. Switches shall be the quick-make, quick-break type. Except for ground lugs which shall be bonded to the housing, parts shall be mounted on insulating bases to permit replacement of any part from the front of the switch. All current carrying parts shall be of high conductivity copper unless otherwise specified and shall be designed to carry rated current without excessive heating. Switch contacts shall be silver tungsten or plated to minimize corrosion, pitting and oxidation and to assure suitable conductivity. Switch handle shall be lockable in either the "ON" or "OFF" position.

1. Provide lugs to accept more than one conductor per phase as required for application. Landing multiple conductors in a single lug is not acceptable.
  2. Provide 2 padlocks for each switch.
  3. Handle interlocked with cover in the “CLOSED” position.
- B.** Enclosed, Non-fusible Switch: NEMA KS 1, Type HD
- C.** Enclosed, Fusible Switch: NEMA KS 1, Type HD, clips to accommodate specified fuses, enclosure consistent with environment where located, and provide rejection type fuse clips with switches.
- D.** Enclosure: NEMA KS 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location:
1. Outdoor Locations: Type 3R.
  2. Fabricate enclosure from steel.
  3. Finish using manufacturer’s standard enamel finish, gray color.

## 2.4 MOLDED CASE CIRCUIT BREAKERS

NEMA AB 1, UL 489, FS W-C-375, lockable handle, with 2 padlocks complying with FED SPEC W-C-375, and the following requirements:

1. Molded case type
2. Quick make, quick break connections with mechanical trip, free switching mechanism
3. Inverse time, thermal trip for overloads. Automatic release secured by bi-metallic thermal element releasing the mechanism latch. Thermal trip calibrated for 40 degree C ambient temperature.
4. Magnetic armature shall be provided to trip the breaker instantaneously for short-circuit currents above the overload range.
5. Automatic tripping shall be indicated by a handle position between the manual “OFF” and “ON” positions.
6. Multi-phase circuit breakers shall have an internal, common trip mechanism to open all poles simultaneously.
7. Circuit breaker shall have mechanical lugs and power distribution connectors sufficient for the number, size, and material of the conductors indicated. Provide lugs to accommodate multiple conductors per phase as required for application. Landing multiple conductors in a single lug is not acceptable.
8. Include provisions for padlocking.
9. Provide poles as indicated on Contract Drawings.
10. Provide ratings as indicated on contract drawings.
  - a. Minimum interrupt rating at 240V: 22,000 AIC symmetrical
  - b. Voltage rating 120/240V.
  - c. Current rating as indicated on Contract Drawings.

## PART-3 EXECUTION

### 3.1 PREPARATION

- A. Verify that surfaces are ready to receive work.
- B. Verify field measurements are as shown on the drawings.
- C. Verify that required utilities are available, in proper location and ready for hookup.

### 3.2 INSTALLATION

- A. Standards Compliance: Materials installed in this Section shall be in accordance with FAA-C-1217G and FAA-STD-019f.
- B. Installation Location: Install disconnect switches and circuit breakers in locations as indicated, according to manufacturer's instructions and as required by the NEC and local codes.
- C. Installation Practice: Install disconnect switches level and plumb, and as required by the NEC and local codes.
- D. Circuit Connection: Connect disconnect switches, circuit breakers and components to wiring system and to ground as indicated and in accordance with manufacturer's recommendations.
- E. Torque Settings: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A.
- F. Circuit Identification: Identify each disconnect switch and circuit breaker according to requirements specified in Section 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS.
- G. Fuse Installation: Install fuses in fused disconnect switches.
- H. Fuses: Refer to Section 26 28 13 FUSES for fuse requirements.
- I. Termination: Connecting more than one conductor to a phase lug is not acceptable.

### 3.3 FIELD QUALITY CONTROL

- A. Testing: After installing disconnect switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
- B. Procedures: Perform each visual and mechanical inspection and electrical tests stated in NETA ATS, Section 7.5 for disconnect switches, Section 7.6 and NEMA AB1 for molded-case circuit breakers. Certify compliance with test parameters.
- C. Correcting Malfunctions: Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.
- D. Visual Inspection: Inspect visually and perform several "On-Off" operations on each circuit breaker.
- E. Circuit Continuity: Verify circuit continuity on each pole in the closed position.

### 3.4 CLEANING

After completing system installation, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches and abrasions.



**END OF SECTION**

**SECTION 26 28 13**  
**FUSES**

**PART-1 GENERAL**

**1.1 SUMMARY**

This Section includes the furnishing of equipment, materials, and incidentals necessary to install fuses.

**1.2 REFERENCE STANDARDS**

Applicable only to the extent specified.

- A. Federal Aviation Administration (FAA)
  - 1. FAA-C-1217G Electrical Work, Interior
  - 2. FAA-STD-019f Lightning and Surge Protection, Grounding, Bonding, and Shielding Requirements for Facilities and Electronic Equipment
- B. National Electrical Manufacturers Association (NEMA)
  - 1. FU-1 Low Voltage Cartridge Fuses
- C. National Fire Protection Association (NFPA)
  - 1. NFPA 70 National Electrical Code (NEC), latest edition
- D. Occupational Safety and Health Administration (OSHA)
  - 1. 29CFR1910.7 Definitions and Requirements for a Nationally Recognized Testing Laboratory (NRTL)

**1.3 SUBMITTALS:**

Product data for each fuse type. Include the following:

- A. Descriptive data and time-current curves.
- B. Let-through current curves for fuses with current limiting characteristics.

**1.4 QUALITY ASSURANCE:**

- A. Comply with NFPA 70 "National Electric Code," latest edition, for components and installation.
- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled:
  - 1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
  - 2. Listing and Labeling Agency Qualifications: A NRTL as defined in OSHA Regulation 1910.7.
- C. Single-Source Responsibility: All fuses shall be the product of a single manufacturer.

## 1.5 EXTRA MATERIALS

Furnish the following extra materials that match products installed, packaged with protective covering for storage, and with identification labels clearly describing contents.

- A. Spare Fuses: A complete set of fuses shall be installed and one set of spares shall be furnished for each fusible device.

## PART-2 PRODUCTS

### 2.1 GENERAL

Materials procured and installed in this Section shall be in accordance with FAA-C-1217G, and FAA- STD-019f.

### 2.2 CARTRIDGE FUSES

Characteristics - NEMA FU 1 nonrenewable cartridge fuse, class as specified or indicated, current rating as indicated, voltage rating consistent with circuit voltage.

## PART-3 EXECUTION

### 3.1 GENERAL

Comply with manufacturer's requirements for installation.

### 3.2 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions to verify proper fuse locations, sizes, and characteristics.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.3 INSTALLATION

Install fuses in fusible devices as indicated. Arrange fuses so fuse ratings are readable without removing fuse.

### 3.4 IDENTIFICATION

Install typewritten labels on inside door of each fused switch to indicate fuse replacement information.

**END OF SECTION**

**SECTION 26 43 13**  
**TRANSIENT-VOLTAGE SUPPRESSION FOR LOW-VOLTAGE ELECTRICAL POWER.**

PART-1        GENERAL

1.1        SUMMARY

This section includes field-mounted TVSS for low-voltage (120 to 240V) power distribution and control equipment.

1.2        REFERENCE STANDARDS

FAA

1. FAA-STD-019F    Lightning Protection, Grounding, Bonding, And Shielding Requirements For Facilities And Electronic Equipment

1.3        DEFINITIONS

- A.    ATS: Acceptance Testing Specifications.
- B.    SVR: Suppressed voltage rating.
- C.    TVSS: Transient voltage surge suppressor(s), both singular and plural; also, transient voltage surge suppression..

1.4        SUBMITTALS

- A. Product data for each type of product indicated. Include rated capacities, operating weights, electrical characteristics, furnished specialties,

1.5        QUALITY CONTROL

- A.    Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application. Comply with ANSI C2.
- B.    Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.
- C.    Comply with NEMA LS 1.
- D.    Comply with UL 1449.
- E.    Comply with NFPA 70.Storage and Handling of Poles
- A.    General: Store poles on decay-resistant treated skids at least 12 inches above grade and vegetation. Support pole to prevent distortion and arrange to provide free air circulation.
- B.    Metal Poles: Retain factory-applied pole wrappings until just before pole installation. For poles with non-metallic finishes, handle with web fabric straps.

1.6        WARRANTY

- A.    Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

## PART-2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Raycap – Rayvoss
  2. Eaton Corporation Co.
  3. Siemens Automation, Inc.
  4. Schneider Electric.

### 2.2 SERVICE ENTRANCE SUPPRESSORS

- A. Peak Single-Impulse Surge Current Rating: 240 kA per mode/480 kA per phase
- B. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2
  1. Line to Neutral: 70,000 A.
  2. Line to Ground: 70,000 A.
  3. Neutral to Ground: 50,000 A.
- C. Protection modes and UL 1449 SVR for 240/120 V, single-phase, 3-wire circuits shall be as follows:
  1. Line to Neutral: 400 V.
  2. Line to Ground: 400 V.
  3. Neutral to Ground: 400 V.

### 2.3 ENCLOSURES

- A. Indoor Enclosures: NEMA 250 Type 1.
- B. Outdoor Enclosures: NEMA 250 Type 3R.

## PART-3 EXECUTION

### 3.1 INSTALLATION

- A. Installing: Install TVSS devices at service entrance on load side, with ground lead bonded to service entrance ground..

### 3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

- B.** Tests and Inspections:
  - 2. 1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.
  - 3. After installing TVSS devices but before electrical circuitry has been energized, test for compliance with requirements.
  - 4. Complete startup checks according to manufacturer's written instructions.
- C.** TVSS device will be considered defective if it does not pass tests and inspections.
- D.** Prepare test and inspection reports.

### 3.3 STARTUP SERVICE

- A.** Do not energize or connect service entrance equipment and panelboards to their sources until TVSS devices are installed and connected.
- B.** Do not perform insulation resistance tests of the distribution wiring equipment with the TVSS installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

### 3.4 DEMONSTRATION

- A.** Train Owner's maintenance personnel to maintain TVSS devices.

**END OF SECTION**

**SECTION 26 51 00**  
**INTERIOR LIGHTING FIXTURES**

**PART-1 GENERAL**

**1.1 SUMMARY**

This Section includes furnishing labor, materials, equipment, and incidentals necessary to install interior lighting fixtures, lamps, exit signs, and accessories.

**1.2 REFERENCE STANDARDS**

Applicable only to the extent specified.

- A. American National Standards Institute (ANSI)
  - 1. C62.41 Recommended Practice on Surge Voltage in Low-Voltage AC Power Circuits
  - 2. C78 Electric Lamps
  - 3. C78.377 Specifications for the Chromaticity of Solid State Lighting Products
- B. Federal Specifications (FS)
  - 1. W-L-305 Light Set, Emergency
  - 2. J-C-30 Cable and Wire, Electrical
- C. Federal Aviation Administration (FAA)
  - 1. C-1217g Electrical Work, Interior
  - 2. STD-019f Lightning and Surge Protection, Grounding, Bonding, and Shielding Requirements for Facilities and Electronic Equipment
- D. Military Standards
  - 1. MIL STD-461 Requirements for Control of Electromagnetic Interference Emissions and Susceptibility User
- E. National Fire Protection Association (NFPA)
  - 1. 70 National Electrical Code (NEC), latest edition
- F. Occupational Safety and Health Administration (OSHA)
  - 1. 29CFR1910.7 Definitions and Requirements for a National Recognized Testing Laboratories (NRTL)
- G. Underwriters Laboratories (UL)
  - 1. 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors
  - 2. 924 Emergency Lighting and Power Equipment
  - 3. 1472 UL Standard for Safety Solid State Dimming Controls
  - 4. 8750 Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products.
- H. National Electrical Manufacturers Association (NEMA)
  - 1. 250 Enclosures for Electrical Equipment
  - 2. SSL 1 Electronic Drivers for LED Devices, Arrays or Systems

- 3. SSL 3 High Power White LED Binning for General Illumination
- 4. SSL 7A Phase-Cut Dimming for Solid State Lighting: Basic Compatibility

### 1.3 DEFINITIONS

- A. Fixture: A complete lighting unit or exit sign. Fixtures include lamps and parts required to distribute light, position and protect lamps, and connect lamps to power supply.
- B. Average Life: The time after which 50 percent fail and 50 percent survive under normal conditions.
- C. Luminaire: Fixture.

### 1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Product Data: Submit product data describing fixtures, lamps, ballasts, support points, weights, accessories, exit, and emergency lighting units. Arrange product data for fixtures in order of fixture designation. Include data on features, accessories, and the following:
  - a. Outline drawings indicating dimensions and principal features of fixtures, lamp and ballast data, support points, weights and accessories for each luminaire type.
  - b. Electrical Ratings and Photometric Data: Certified results of independent laboratory tests for fixtures and lamps.
  - c. Manufacturer's installation instructions under general provisions.
- B. Maintenance data for fixtures to include in the operation and maintenance manual.

### 1.5 QUALITY ASSURANCE

- A. Electrical Component Standard: Provide components that comply with NFPA 70 and that are listed and labeled by UL.
- B. Listing and Labeling: Provide fixtures and accessory components that are listed and labeled for their indicated use and installation conditions on the Project.
  - 1. Special Listing and Labeling: Provide fixtures for use in damp or wet locations and recessed in combustible construction that are specifically listed and labeled for such use. Provide fixtures for use in locations classified as hazardous that are listed and labeled for the specific hazard.
  - 2. The Terms "Listed" and "Labeled:" As defined in the National Electrical Code, Article 100, latest edition.
  - 3. Listing and Labeling Agency Qualifications: An NRTL as defined in OSHA Regulation 1910.7.
- C. Ballast Manufacturer's Qualifications: Acceptable Manufacturers shall be firms regularly engaged in the design, manufacture and testing of commercial or industrial lighting fixtures and ballasts for at least five years.
- D. Coordination: Coordinate fixtures, mounting hardware, and trim with ceiling system and other items, including work of other trades, required to be mounted on ceiling or in ceiling space.



## 1.6 DELIVERY, HANDLING, AND STORAGE

Ship light fixtures inside protective cartons and keep packaged until installed. Deliver lamps to job site in the original packaging case and sleeves.

## 1.7 SITE CONDITIONS

- A. Provide cold weather ballasts in fixtures that are subject to temperatures below 32 degrees F.
- B. Provide special mounting, enclosures, and fire safety, as required by the codes having jurisdiction so that the integrity of the UL listed ceiling assemblies is maintained.
- C. Provide UL labels where fixtures are subject to moisture.
- D. Provide DL or WI labels on fixtures required for the location.

## 1.8 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

## PART-2 PRODUCTS

### 2.1 GENERAL

Materials procured and installed in this Section shall be in accordance with FAA C-1217G and FAA STD-019f.

### 2.2 FIXTURES, GENERAL

Comply with the requirements specified in the Articles below and lighting fixture schedule indicated on the Contract Drawings.

- A. Provide the lighting fixtures as specified and scheduled on the Contract Drawings.
- B. Substitutes: Fixtures specified in the lighting fixture schedule on Contract Drawings establish a level of quality and appearance that any substituted fixtures must match or exceed. Submit substitutions for the specified fixtures to the WRPM for approval.
- C. All lighting fixtures shall be UL approved and shall bear the UL label.
- D. LED Drivers: LED drivers must be electronic, UL Class 1, constant-current type and comply with the following requirements:
  - 1. Output power (watts) and luminous flux (lumens) as shown in luminaire schedule for each luminaire type to meet minimum luminaire efficacy (LE) value provided.
  - 2. Power Factor (PF) greater than or equal to 0.9 over the full dimming range when provided.
  - 3. Current draw Total Harmonic Distortion (THD) of less than 20 percent.
  - 4. Class A sound rating.
  - 5. Operable at input voltage of 120-277 volts at 60 hertz.

6. Minimum 5 year manufacturer's warranty.
  7. RoHS compliant.
  8. Integral thermal protection that reduces or eliminates the output power if case temperature exceeds a value detrimental to the driver.
  9. UL listed for dry or damp locations typical of interior installations.
  10. Where applicable, fully-dimmable using 0-10V control as indicated in luminaire schedule.
- E. LED Light Sources**
1. Correlated Color Temperature (CCT) of 3500 degrees K.
  2. Minimum Color Rendering Index (CRI) R9 value of 80.
  3. High power, white light output utilizing phosphor conversion (PC) process or mixed system of colored LEDs, typically red, green and blue (RGB).
  4. RoHS Compliant.
  5. Provide light source color consistency by utilizing a binning tolerance within a 4step McAdam ellipse

### 2.3 FIXTURE COMPONENTS, GENERAL:

- A. Metal Parts:** Free from burrs and sharp corners and edges.
- B. Sheet Metal Components:** Steel, except as indicated. Components are formed and supported to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access:** Smooth operating, free from light leakage under operating conditions, and arranged to permit re-lamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during re-lamping and when secured in operating position.
- D. Reflecting Surfaces:** Minimum reflectance as follows, except as otherwise indicated:
  1. White Surfaces: 85 percent.
  2. Specular Surfaces: 83 percent.
  3. Diffusing Specular Surfaces: 75 percent.
  4. Laminated Silver Metallized Film: 90 percent.
- E. Lenses, Diffusers, Covers, and Globes:** 100 percent virgin acrylic plastic except as otherwise indicated.
  1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
  2. Lens Thickness: 0.125 inch minimum, except where greater thickness is indicated.
- F. Wiring:** Fixture wiring shall be thermoplastic insulated copper, rated for 600 volts, in accordance with F.S. J-C-30 and the NEC.

G. Flexible Raceway: Flexible metal raceway is permitted for concealed interior installations only.

## 2.4 SUSPENDED FIXTURE SUPPORT COMPONENTS

- A. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.
- B. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.
- C. Rod Hangers: 1/4-inch minimum diameter, cadmium-plated, threaded steel rod.
- D. Hook Hanger: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

## 2.5 EXIT LIGHTS

Conform to UL 924 "Emergency Lighting and Power Equipment," and the following:

1. Sign Colors: Conform to local code.
2. Minimum Height of Letters: Conform to local code.
3. Arrows: Include as indicated.
4. Lamps for AC Operation: Light Emitting Diode (LED) array.

## 2.6 EMERGENCY LIGHTING

Conform to UL924 "Emergency Lighting and Power Equipment," and Federal Specification W-L-305, Type I, Class 1, Style D or E, with the number of heads as indicated on the drawings and the following:

1. Housing: Retractable with flush mounted door
2. Power Supply: Remote nickel cadmium battery pack
3. Integral Test Module: Self diagnostic monitoring system
4. Finish: white powder coat finish to be custom painted to match surrounding finishes in the field.
5. Power Cord: No more than three feet in length, plugged in to a single-gang receptacle (or hard wired).
6. Connect to the same branch circuits that provide normal lighting to the area, ahead of any local switches.

## 2.7 FINISHES

Manufacturer's standard finish applied over corrosion-resistant treatment or primer, free of streaks, runs, stains, blisters, and similar defects. Remove fixtures showing evidence of corrosion during project warranty period and replace with new fixtures.

## PART-3 EXECUTION

### 3.1 GENERAL

Installation of lighting systems shall be in accordance with FAA C-1217G and FAA STD-019f.

### 3.2 INSTALLATION

- A. Installation: Install lamps in luminaries and lamp holders and set units plumb, square and level with ceilings and walls, and secure according to manufacturer's written instructions and approved Shop Drawings.
- B. Finishes: Check the architectural finishes and provide fixtures with proper trim, frames, and other hardware required to coordinate with the proper finishes, regardless of the specified or scheduled catalog numbers, prefixes and suffixes.
- C. Support for Suspended Fixtures: Brace pendants and rods over 48 inches long to limit swinging. Support stem-mounted, single-unit, suspended fluorescent fixtures with trim-stem hangers. For continuous rows, use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of chassis, including one at each end.
- D. Emergency Fixtures: All emergency lighting fixtures shall be (plug-in or hardwired).
- E. Recessed Lighting: Install recessed lights to permit removal from below. Install gird clips.
- F. Hardware: Install straps, mounting plates, nipples, and/or brackets for proper installation.

### 3.3 CONNECTIONS AND GROUNDING

- A. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not specified, use those specified in UL 486A. Ground fixtures in accordance with FAA C1217G, paragraph 4.4.5.2.
- B. External bonding jumpers are not required across flexible metal raceway.

### 3.4 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Give advance notice of dates and times for field tests.
- C. Provide instruments to make and record test results.
- D. Tests: Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation. All fixtures shall be energized upon completion of installation for a period of 72 hours, upon which contractor shall replace any lamps or ballasts which are not operating properly.
- E. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.
- F. Report results of all tests.
- G. Replace fixtures that show evidence of corrosion during Project warranty period.

### 3.5 ADJUSTING AND CLEANING

- A. Immediately before final inspection clean fixtures inside and out including plastics and glassware. Use methods and materials recommended by manufacturer.
- B. Adjust all trim, aim fixtures in the presence of the WRPM to provide required light intensities.
- C. Touch up luminaire finish at the completion of the work.
- D. Replace broken or damaged parts.
- E. Test all fixtures for electrical, as well as mechanical operation.
- F. Replace luminaries that have failed at completion of work.
- G. Align luminaries and clean lenses and diffusers at completion of the work. Clean paint splatters, dirt, and debris from installed luminaries.

**END OF SECTION**

**SECTION 26 56 00**  
**EXTERIOR LIGHTING FIXTURES**

PART-1      GENERAL

1.1      SUMMARY

This section includes furnishing labor, materials, equipment, and incidentals necessary to install exterior lighting fixtures, lamps, ballasts, pole standards, and accessories.

1.2      REFERENCE STANDARDS

- A.      American National Standards Institute (ANSI)
  - 1.    C2                      National Electric Safety Code
  - 2.    C78.377                Specification for the Chromaticity of Solid State Lighting Products
- B.      American Standards for Testing and Materials (ASTM)
  - 1.    A500                    Cold formed welded and seamless carbon steel structural tubing in rounds and shapes.
- C.      National fire Protection Agency (NFPA)
  - 1.    70                      National Electrical Code (NEC), latest edition.
- E.      Occupational Safety and Health Administration (OSHA)
  - 1.    29CFR1910.7        Description and requirements for a Nationally Recognized Testing Laboratory (NRTL)
- F.      Underwriters Laboratories (UL)
  - 1.    773                    Plug-in locking type photo-controls for use with area lighting
  - 2.    917                    UL Standard for Safety Clock-Operated Switches
  - 3.    8750                   Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products
- G.      Federal Standards (FS)
  - 1.    J-C-30                Cable and wire, electrical

1.3      DEFINITIONS

- A.      Fixture: A complete lighting device. Fixtures include a lamp or lamps and parts required to distribute light, position and protect lamps, and connect lamps to power supply.
- B.      Lighting Unit: A fixture or an assembly of fixtures with a common support, including a pole or bracket plus mounting and support accessories.
- C.      Luminaries: A fixture.

## 1.4 SUBMITTALS

Parsons WRPM approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Product data describing fixtures, lamps, ballasts, poles, and accessories. Arrange product data for fixtures in order of fixture designation. Include data on features, poles, accessories, finishes, and the following:
  - a. Outline drawings indicating dimensions and principal features of fixtures and poles.
  - b. Electrical ratings and photometric data: Certified results of independent laboratory test for fixtures and lamps.
- B. Shop Drawings: Shop drawings detailing wiring for control system showing both factory-installed and field-installed wiring, components, and accessories.
- C. Wiring Diagrams: Wiring diagrams detailing wiring for control system showing both factory-installed and field-installed wiring for specific system of this Project and differentiating between factory-installed and field-installed wiring.
- D. Product certificates signed by manufacturers of lighting units certifying that their products comply with specified requirements.
- E. Field test reports indicating, and interpreting test results specified in Part 3 of this Section.
- F. Maintenance data for products.

## 1.5 QUALITY CONTROL

- A. Electrical Component Standard: Provide components that comply with NFPA 70, latest edition and that are listed and labeled by UL.
- B. Comply with ANSI C2.
- C. Listing and Labeling: Provide fixtures and accessories specified in lighting fixture schedule that are listed and labeled for their indicated use and installation conditions on Project.
  - 1. The Terms “Listed” and “Labeled”: As defined in the National Electrical Code, Article 100.
  - 2. Listing and Labeling Agency Qualifications: A “Nationally Recognized Testing Laboratory” (NRTL) as defined in OSHA Regulation 1910.7.

## 1.6 STORAGE AND HANDLING OF POLES

- A. General: Store poles on decay-resistant treated skids at least 12 inches above grade and vegetation. Support pole to prevent distortion and arrange to provide free air circulation.
- B. Metal Poles: Retain factory-applied pole wrappings until just before pole installation. For poles with non-metallic finishes, handle with web fabric straps.

## 1.7 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

- B.** Special Warranty: Submit a written warranty signed by Manufacturer and Subcontractor agreeing to replace external parts of lighting fixtures exhibiting a failure of finish as specified below.
1. Protection of metal from corrosion: Warranty against perforation or erosion of finish due to weathering.
  2. Color retention of housing and pole: Warranty against fading, staining, and chalking due to effect of weather and solar radiation.
  3. Special Warranty Period: 5 years from date of Substantial Completion.

## PART-2 PRODUCTS

### 2.1 MANUFACTURERS

- A.** Products: Provide the lighting units as specified and scheduled on the Contract Drawings.
- B.** Substitutes: Fixtures specified in the lighting units schedule on Contract Drawings establish a level of quality and appearance that any substituted fixtures must match or exceed. Submit substitutions for the specified fixtures to the WRPM for approval.

### 2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

Provide luminaires complete with light sources of quantity, type, and wattage indicated. All luminaires of the same type shall be provided by the same manufacturer. Provide Energy Star labeled LED luminaire product. Provide proof of Energy Star label for LED luminaire product.

- A.** LED luminaire housings shall be die-cast or extruded aluminum. Housings for luminaires other than LED shall be die cast, extruded, or fabricated aluminum. Fabricated aluminum housings shall have all seams and corners internally welded to resist weathering, moisture and dust.
- B.** LED luminaires shall be rated for operation within an ambient temperature range of minus 30 degrees C minus 22 degrees F to 40 degrees C 104 degrees F.
- C.** Luminaires shall be UL listed for wet locations per UL 1598. Optical compartment for LED luminaires shall be sealed and rated a minimum of IP65 per NEMA IEC 60529.
- D.** LED luminaires shall produce a minimum efficacy as shown below: (tested per IES LM-79. Theoretical models of initial raw LED lumens per watt are not acceptable).
1. Pole Mounted Luminaires – 65 Lumens/Watt
  2. Wall Mounted Luminaires – 60 Lumens/Watt
- E.** Luminaires shall have IES distribution and NEMA field angle classifications as indicated in luminaire schedule on project plans per IES HB-10.
- F.** Housing finish shall be baked-on enamel, anodized, or baked-on powder coat paint. Finish shall be capable of surviving ASTM B117 salt fog environment testing for 2500 hours minimum without blistering or peeling.
- G.** Luminaires shall not exceed the following IES TM-15 Backlight, Uplight and Glare (B.U.G.) ratings:



1. Maximum Backlight (B) rating shall be determined by lighting zone in which luminaire is placed.
  2. Maximum Uplight (U) rating shall be U0.
  3. Maximum Glare (G) rating shall be determined by lighting zone in which luminaire is placed.
- H.** Luminaires shall be fully assembled and electrically tested prior to shipment from factory.
- I.** The finish color shall be as indicated in the luminaire schedule or detail on the project plans.
- J.** Luminaire arm bolts shall be 304 stainless steel or zinc-plated steel.
- K.** Luminaire lenses shall be constructed of UV-resistant acrylic.
- L.** The wiring compartment on pole-mounted, street and area luminaires must be accessible without the use of hand tools to manipulate small screws, bolts, or hardware.
- M.** Incorporate modular electrical connections, and construct luminaires to allow replacement of all or any part of the optics, heat sinks, power supply units, ballasts, surge suppressors and other electrical components using only a simple tool, such as a manual or cordless electric screwdriver.
- N.** Luminaires shall have a nameplate bearing the manufacturer's name, address, model number, date of manufacture, and serial number securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.
- O.** Roadway and area luminaires shall have an integral tilt adjustment of plus or minus 5 degrees to allow the unit to be leveled in accordance with ANSI C136.3.
- P.** Luminaire must pass 3G vibration testing in accordance with NEMA C136.31.
- Q.** All factory electrical connections shall be made using crimp, locking, or latching style connectors. Twist-style wire nuts are not acceptable.

### 2.3 LED LIGHT SOURCES:

- A.** Correlated Color Temperature (CCT) shall be in accordance with NEMA ANSLG C78.377: Nominal CCT: 4000 degrees K: 3985 plus or minus 275 degrees K
- B.** Color Rendering Index (CRI) shall be greater than or equal to 70 for 4000 degrees K light sources.
- C.** Color Consistency:
  1. Manufacturer shall utilize a maximum 4-step MacAdam ellipse binning tolerance for color consistency of LEDs used in luminaires.

### 2.4 LED DRIVERS

- A.** LED Power Supply Units (Drivers) shall meet the following requirements:
- B.** Minimum efficiency shall be 85 percent.
- C.** Drive current to each individual LED shall not exceed 600 mA, plus or minus 10 percent.

- D. Shall be rated to operate between ambient temperatures of minus 30 degrees C minus 22 degrees F and 40 degrees C 104 degrees F [ 50 degrees C 122 degrees F].
- E. Shall be designed to operate on the voltage system to which they are connected, typically ranging from 120 V to 480 V nominal.
- F. Operating frequency shall be: 50 or 60 Hz.
- G. Power Factor (PF) shall be greater than or equal to 0.90.
- H. Total Harmonic Distortion (THD) current shall be less than or equal to 20 percent.
- I. Shall meet requirements of 47 CFR 15, Class B.
- J. Shall be RoHS-compliant.
- K. Shall be mounted integral to luminaire. Remote mounting of power supply is not allowed.
- L. Power supplies in luminaires mounted under a covered structure, such as a canopy, or where otherwise appropriate shall be UL listed with a sound rating of A.

## 2.5 FINISHES

- A. Metal Parts: Manufacturer's standard finish, except as otherwise indicated, applied over corrosion-resistant primer, free of streaks, runs, stains, blisters and similar defects.
- B. Other Parts: Manufacturers standard finish, except as otherwise indicated.

## PART-3 EXECUTION

### 3.1 INSTALLATION

- A. Installing: Set units plumb, square, level, and secure according to manufacturers written instructions and approved shop drawings.
- B. Concrete Foundations: Construct according to Section 03 00 00 CONCRETE.
- C. Pole Installation: Use web fabric slings (not chain or cable) to raise and set poles.
- D. Fixture Attachment: Fasten to structural supports or as indicated on drawings.
- E. Lamping: Install lamps into fixtures according to manufacturers written instructions. Replace malfunctioning lamps.
- F. Mounting: Use mountings that correctly position luminaire to provide indicated light distribution.

### 3.2 TESTING

- A. Notice: Give WRPM 5 day advance notice of dates and times for field tests.
- B. Record: Provide instruments to make and record test results.
- C. Tests and Observations: Verify normal operation of lighting units after installing fixtures and energizing circuits with normal power source. Operate lighting systems for 72 hours continuously. Include the following.
  1. Photometric Test: Measure light intensities at night at locations where specific illumination performance is indicated. Use photometers with calibration referenced to National Institute Standards and Technology (NIST) standards.

2. Check for intensity of illumination.
  3. Check for uniformity of illumination.
  4. Check for excessively noisy ballasts.
  5. Prepare written report of tests indicating actual illumination results.
- D.** Replace or Repair: Replace or repair malfunctioning units, make necessary adjustments, and reset. Repeat procedure until all units operate properly.

### 3.3 ADJUSTING AND CLEANING

- A.** Inspect each installed unit for damage. Replace damaged fixtures and components.
- B.** Clean units after installation. Use methods and materials recommended by manufacturer.
- C.** Adjust aimable fixtures to provide required light intensities.

**END OF SECTION**

## SECTION 31 00 00 EARTH WORK

### PART-1 GENERAL

#### 1.1 SECTION INCLUDES

This Section includes the excavation and backfilling requirements for underground utilities, foundations, and appurtenances

Work Included: The work under this Section includes, but is not limited to the following:

- A. Sub-base courses for existing access roads to be removed
- B. Backfilling for utilities.
- C. General excavation and fill to include stripping and salvaging top soil, stockpiling soil, and spreading topsoil.
- D. Erosion and Sediment Control.
- E. Protection of Underground Utilities.

#### 1.2 STANDARDS AND REFERENCES:

The current issues of the following documents in effect on the date of the request-for proposal form a part of this specification and are applicable to the extent specified herein.

Unless otherwise indicated on the Construction Drawings or herein specified, all work under this Section shall be performed in accordance with the current State Department of Transportation Standard Specifications for Construction of Roads and Bridges

##### 1.2.1 American Association of State Highway and Transportation Officials (AASHTO):

T-99– Moisture-Density Relations of Soils Using 5.5 lb (2.5 Kg) Rammer and 12-in. (305 mm) Drop.

##### 1.2.2 American Society of Testing and Materials (ASTM) Publications:

ASTM D-1557 Moisture-Density Relationship of Soils and Soil Aggregate Mixtures.

ASTM D-2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

ASTM D-4253 Test Methods for Maximum Index Density of Soils Using a Vibratory Table

ASTM D-4254 Test Methods for Minimum Index Density of Soils and Calculations of Relative Density

##### 1.2.3 Natural Resources Conservation Service, (NRCS)

#### 1.3 DEFINITIONS:

The following terms shall mean the following for this contract:

- A. **Excavation:** Consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.
- B. **Sub-grade:** The uppermost surface of an excavation or the top surface of a fill or backfill immediately below sub-base, drainage fill, or topsoil materials.

- C. **Sub-base Course:** The layer placed between the subgrade and base course in a paving system or the layer placed between the subgrade and surface of a pavement or walk.
- D. **Base Course:** The layer placed between the sub-base and surface pavement in a paving system.

**1.4 SUBMITTALS:**

Parsons WRPM approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Gradation and compaction reports.
- B. Name of site-material source and load ticket for each delivery.
- C. Name of testing firm/lab.
- D. As-Built drawings

**PART-2 PRODUCTS**

**2.1 SOIL MATERIALS**

- A. **Sub-base and Base Material:** Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand, as defined in the State DOT Standards for sub-base course.
- B. **Structural Fill:** At least 12 inches of compacted structural fill meeting the gradation provided in table 1. Up to a 50 percent blend of recycled crushed concrete and asphalt with virgin aggregate can be used, provided it meets the gradation I n table 1. If recycled materials are used, limit the amount of recycled asphalt to 25 percent.

**TABLE 1: Structural Backfill/Crushed Base Course**

Sieve Size	Percent Passing
3/4"	90 - 100
3/8"	70 - 90
No. 4	40 - 70
No. 10	25 - 55
No. 200	2 - 8

- C. **Foundation Backfill:** Foundation backfill shall be crushed stone, well-graded from coarse to fine, other aggregate, or an approved sand-gravel mixture. No overburden or decomposed and disintegrated rock allowed. The material shall meet the following gradation 100 percent passing a 1 1/2 inch sieve, 80-100 percent passing a 1 inch sieve and 0-5 percent passing a No. 8 sieve.
- D. **Filtering Material:** Evenly graded mixture of natural or crushed gravel or crushed stone and natural sand, with 100 percent passing a 1-1/2 inch sieve and 0 to 5 percent passing a No. 50 sieve.
- E. **Earth Fill:** Approved type of soil classified as GW, GP, GM, GC, SW, SP, SM, SC, ML or CL according to the Unified Soil Classification System and free of foreign substances, obtained from excavation for this construction or an approved source and having a plasticity index of 20 or less.

Excavated material that meets the requirements for earth fill may be used for filling, backfilling, and grading.

- F. **Unsuitable Fill:** Any material construction debris, containing roots or other organic matter, such as peat, organic silt, or sod, shall be considered unsuitable for use as backfill material or in embankment construction.
- G. **Top Soil:** Top layer of soil containing organic material suitable for growing grass and other vegetative materials, free of roots, debris, and other deleterious materials. Topsoil from an off-site location must be from an approved source and have similar characteristics as the on-site topsoil.

## PART-3 EXECUTION

### 3.1 EXCAVATION:

- A. Excavation shall be to the contours and dimensions indicated on construction drawings. Notify the RE and Subcontract Administrator immediately in writing in the event that it becomes necessary to remove hard, soft, weak, or wet material to a depth greater than indicated in order for any adjustment in subcontract price to be considered. Excavations cut below the depths indicated shall, unless otherwise specified, be backfilled with fill or granular fill and be compacted in a manner acceptable to the RE.
- B. **In case of an accident and/or damage to an existing utility, the Subcontractor shall:**
  - 1. Immediately report all damages to Parsons.
  - 2. Create a Damage Investigation Report in accordance with this construction document set and the Subcontractor's Site Specific Safety Plan, and submit to the RE. Pictures shall be taken and attached to the report to help documenting the damage.
- C. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.
- D. Preserve, protect and maintain existing operable drains, sewers, and electrical ducts during grading, excavating and backfilling operations. Keep excavations dry. Locations indicated for existing utility facilities are approximate. Pipes or other manmade obstructions, in addition to those indicated, may be encountered. Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Subcontractor's risk. Perform all work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility owner. Excavation made with power driven equipment is not permitted within five feet of any known existing utility. Start hand excavation on each side of the indicated obstruction and continue the obstruction is uncovered. Support uncovered lines until approval for backfill is granted by the RE.
- E. Excavation shall be performed so that the area of the site and the area immediately surrounding the site and affecting operations at the site will be continually and effectively drained. Water shall not be permitted to accumulate in the excavation. The excavation shall be drained by pumping or other satisfactory methods to prevent softening of the foundation bottom, undercutting of footings, or other actions detrimental to proper construction procedures.
- F. Plan for and provide the equipment and construction for the collection and disposal of surface and subsurface water encountered in the course of construction.
- G. Where it is necessary to cross paved areas, the pavement surface shall be saw-cut to a minimum depth of 2 inches. Lines shall be straight and true to ensure a neat finish between the existing and restored surfaces. The width of excavated pavement shall extend 1 foot and 6 inches beyond each side of the proposed excavated width for the trench in the subgrade below. Permission of the RE shall be obtained before starting any such trenching. All rubble and waste material from this operation shall be completely removed from the site.
- H. Where existing paved surfaces have been removed to allow for utility line crossings, backfill trenches as specified below. Replace the pavement with material of thickness and proportions that

are as near to those of the existing pavement as can practically be accomplished, or as otherwise specified.

- I. Satisfactory excavated material shall be used in the work. No excavated material shall be disposed of in such a manner as to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.
- J. When excavations have reached the required elevations, the Subcontractor shall not proceed with further construction of the excavated area, until the area has been inspected by the RE.
- K. The excavated soils shall not be re-used onsite as fill beneath the building site or beneath the pavement surfaces.
- L. **Excavate trenches to indicated slopes, lines, depths, and invert elevations.**
  - 1. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
  - 2. Clearance: 12 inches (300 mm) each side of pipe or conduit.
  - 3. Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove stones and sharp objects to avoid point loading. For pipes or conduit less than 6 inches (150 mm) in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
- M. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

## **3.2 BACKFILL**

### **3.2.1 General**

- A. Prior to backfilling, the owners/operators of existing facilities/utilities that were exposed during potholing or excavation shall be contacted and given the opportunity to inspect for damage that may have occurred during the excavation process. All responses and inspections shall be documented.
- B. The Subcontractor shall take care not to damage existing facilities and utilities during backfill and compaction.
- C. All material used to backfill potholed or excavated existing utilities shall be clean and free of large rocks, sharp objects, and large chunks of hard-packed dirt or clay. The requirements for backfill may be found in FAA-C-1391d, Installation and Splicing of Underground Cables. The utility owner/operators shall be contacted for additional requirements regarding their utilities.

### **3.2.2 Foundation Excavation/ Backfill:**

Backfill excavations promptly with Foundation Backfill, but not before completing the following:

- A. Acceptances of construction below finish grade including, where applicable, damp proofing, waterproofing, perimeter insulation and underground utilities.
- B. Concrete formwork removal.

- C. Removal of trash and debris any deleterious materials and unsatisfactory soil materials from excavation.

### **3.2.3 Backfill Material:**

- A. Preparation: Remove vegetation, topsoil, debris, wet, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.
- B. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.
- C. Subgrade or existing ground surface which is to receive fill has a density less than that required for fill, break up ground surface to depth required, pulverize, moisture-condition or aerate soil and recompact to required density as indicated in this specification.
- D. Place fill material in layers to required elevations for each location listed below. Flooding is not permitted.
- E. Under grass, use satisfactory excavated or borrow soil material, except top 3", use topsoil material.
- F. Under walks and pavements, use sub-base or base material or satisfactory excavated or borrow soil materials.
- G. Under footings and foundations, use structural fill.

### **3.2.4 Moisture Control:**

- A. Uniformly moisten or aerate sub-grade and each subsequent fill or backfill layer before compaction to within 3 percent of optimum moisture content.
- B. Do not place backfill or fill material on surfaces that are muddy or has exceeds moisture.
- C. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.
- D. Stockpile or spread and dry removed wet satisfactory soil material.

### **3.2.5 Compaction:**

- A. Place backfill and fill materials in layers not more than 6 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.
- C. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to AASHTO T-99.
  - 1. Under existing building foundation compact the top 12 inches below subgrade and each layer of backfill or fill material to 95 percent maximum dry density.
  - 2. Under walkways, compact the top 6 inches below subgrade and each layer of backfill or fill material to 95 percent maximum dry density.
  - 3. Under lawn or unpaved areas, compact the top 6 inches below subgrade and each layer of backfill or fill material to 90 percent maximum dry density.
- D. Trench Compaction Requirements:
  - 1. Compact earth fill and cohesive aggregate fill in maximum 6 inch lifts with pneumatic rollers or power hand tampers and make a minimum of eight (8) passes.



2. Compact cohesionless aggregate fill in maximum 6 inch lifts with vibratory rollers or vibratory plate power hand compactors and make a minimum of eight (8) passes.
3. The acceptability of the compaction equipment shall be based upon the results of a test section.
4. Compact earth fill and cohesive aggregate fill to a minimum of 95% of maximum dry density as determined by ASTM D-1557, Modified Proctor by using nuclear methods.
5. Compact cohesionless aggregate fill on which it is not practical to control the density by "Proctor" methods to a minimum of 75% of relative density as determined by ASTM D-4253 and D-4254, by a field compaction mold method correlated to ASTM D-4253 and D-4254. Compact cohesionless aggregate fill at moisture content within a range that accommodates consistent placement and compaction to the minimum relative density specified above.

### **3.3 GRADING**

#### **3.3.1 General:**

Uniformly grade areas to a smooth surface free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

- A. Provide a smooth transition between existing adjacent grades and new grades.
- B. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.

#### **3.3.2 Site Grading:**

Slope grades to direct water away from structures and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

- A. Lawn or Unpaved Areas: Plus or minus 1 inch.
- B. Walks: Plus or minus 1 inch.
- C. Pavements: Plus or minus 1/2 inch.

#### **3.3.3 Sub-base and Base Courses:**

Under pavements and walks, place sub-base course material on prepared subgrades. Place base course material over sub-bases to pavements.

- A. Grade and compact sub-base and base courses to grades, lines, cross sections and thickness to not less than shown on the Construction Drawings.
- B. Shape sub-base and base to required elevations and cross-slope grades.
- C. When thickness of compacted sub-base or base course is 6 inches or less, place materials in a single layer.
- D. When thickness of compacted sub-base or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

#### **3.3.4 Drainage Fill:**

- A. Under slabs-on-grade, place drainage fill of course aggregates on prepared subgrade.
- B. Compact drainage fill to required cross sections and thickness.
- C. When compacted thickness of drainage fill is 6 inches or less, place materials in a single layer.

- D. When compacted thickness of drainage fill exceeds 6 inches thick place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

### 3.3.5 Field Quality Control:

- A. Testing Agency Services: Allow testing agency to inspect and test each subgrade, sub –base and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements. Unless otherwise specified in these specifications, all testing shall be in accordance with DOT standard procedures.
- B. Footing Subgrade: At footing subgrades, perform at least one test of each soil stratum to verify design-bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of each subgrade with related tested strata when acceptable to the PM Designee.
- C. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests per layer.
- D. When testing agency reports that subgrades, fills, backfills, subbase or bases are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, re-compact and retest until required density is obtained at no additional cost to the government.

### 3.3.6 Disposal of Surplus and Waste Materials

- A. Disposal: Transport surplus satisfactory soil to designated storage areas on the Government 's property. Stockpile or spread soil as directed by PM Designee. Protect stockpiles from erosion. Seed and/or stabilize stockpiled material as directed by the PM Designee.
- B. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Government 's property.
- C. No burning of materials shall be permitted on the site.

**END OF SECTION**

**THIS PAGE INTENTIONALLY LEFT BLANK**

**SECTION 31 23 00**  
**EXCAVATION AND FILL**

**PART-1 GENERAL**

**1.1 WORK INCLUDED:**

The work under this Section includes, but is not limited to furnishing labor, materials, equipment and incidentals necessary to perform trenching, direct burial of conduit, backfilling, handling, storage, transportation and disposal of excavated material; pumping and dewatering; preparation of sub-grades; protection of adjacent property; fills, grading; and other appurtenant work.

**1.2 STANDARDS AND REFERENCES:**

Unless otherwise indicated on the Construction Drawings or herein specified, all work under this Section shall be performed in accordance with the current Department of Transportation (DOT) Standard Specifications for Construction of Roads and Bridges.

**1.2.1 American Society of Testing and Materials (ASTM) Publications:**

ASTM A-139	Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)
ASTM D-448	Standard Classification for Sizes of Aggregate for Road and Bridge Construction
ASTM D-698	Moisture-Density Relationship of Soils and Soil Aggregate Mixtures, Using 5.5 -lb Rammer and 12 Inch Drop
ASTM D-1556	Density of Soil in Place by the Sand Cone Method
ASTM D-1557	Moisture-Density Relationship of Soils and Soil Aggregate Mixtures.
ASTM D-2487	Classification of Soils for Engineering Purposes
ASTM D-2922	Density of Soil and Soil - Aggregate In-Place by Nuclear Methods
ASTM D-3017	Moisture Content of Soil and Soil - Aggregate In-Place by Nuclear Methods
ASTM D-3350	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
ASTM D-4253	Test Methods for Maximum Index Density of Soils Using a Vibratory Table
ASTM D-4254	Test Methods for Minimum Index Density of Soils and Calculations of Relative Density
ASTM F-714	Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

Any other testing required by these specifications and not specifically referenced to a standard shall be performed under ASTM or other appropriate standards.

Reference herein or on the Construction Drawings to soil classifications shall be understood to be according to ASTM D-2487, "Classification of Soils for Engineering Purposes" unless indicated otherwise.

**1.3 JOB CONDITIONS**

- A. Excavations shall include material of whatever nature encountered, including but not limited to clays, sands, gravel, conglomeritic boulders, weathered clay shales, rock, abandoned underground utilities, debris and abandoned existing structures. Excavation and trenching shall include the removal and subsequent handling of materials excavated or otherwise handled in the performance of the work.

- B. Trench excavation shall consist of excavation to the lines and grades indicated, required for installation of direct burial of conduit and backfill.
- C. Earth removed from excavations and which is not required for backfill shall be spoiled on site as directed by the RE, or shall be removed from the site by the Subcontractor at no cost to the Government.

**1.4 SUBMITTALS**

Parsons WRPM approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Gradation and compaction reports, names of material sources and testing lab.
- B. "As-Built" drawings.
- C. Work Plan/Contingency Plan and disconnect location sketch.

**PART-2 PRODUCTS**

**2.1 MATERIALS:**

Excavated materials to be used for backfill may be deposited in stockpiles at points convenient for re-handling the material during the backfilling process. The location of stockpiles shall be within the limits of work. Keep drainage channels clear of stockpiled materials and control sediment transport. Unsuitable excavated material shall not be used for backfill and shall be handled in accordance with this construction document set.

**2.2 BACKFILL OR EMBEDMENT**

**2.1 MIXES; SAND-CEMENT BACKFILL OR EMBEDMENT**

- A. **Sand:** Sand shall be free of any cohesive material and shall meet the following gradation and plasticity index requirements:

<u>Sieve Size</u>	<u>Percent Passing</u>
1/2 inch	100
3/8 inch	97 - 100
No. 4	92 - 100
No. 8	75 - 100

Plasticity Index 10 Maximum

Liquid Limit 25 or less

**2.2 HDPE PIPE:**

High Density Polyethylene Pipe (HDPE) shall conform to ASTM D3350 having a cell classification of PE 345434C and a Plastic Pipe Institute rating of PE 3408. Dimensions and workmanship shall conform to ASTM F714.

**2.3 STEEL PIPE:**

Smooth wall carbon steel casing pipe shall be new and unused and meet or exceed the requirements of ASTM A139 Grade B (without hydrostatic testing). Minimum thickness is 0.250 inches. Minimum yield strength is 35,000 psi.

## 2.4 ACCESSORIES:

Drilling fluid to be Bentonite slurry compatible with the soil and drilling equipment. Mix design is the responsibility of the Subcontractor.

## PART-3 EXECUTION

### 3.1 PREPARATION

#### 3.1.1 Site:

Do not remove trees unless indicated on the Construction Drawings or unless the RE authorizes their removal in writing. Adequately protect the trees left standing from permanent damage by construction operations. Standing trees may be trimmed where necessary to facilitate construction, but only with written authorization from the RE.

#### 3.1.2 Protection of Existing Structures and Utilities:

Existing underground facilities and utility lines shall be protected and located.

- A. Where construction endangers adjacent structures, utilities, embankments and/or roadways, the Subcontractor shall, at their own expense, carefully support and protect such structures so that work can be done safely and without damage throughout the construction process. In case damage should occur, the Subcontractor shall be responsible for restoration.
- B. Restore, repair or replace to the satisfaction of the RE damaged items to a condition equal to or better than the original condition and of same or better material and quality.
- C. Protect open excavation from vehicle and pedestrian traffic with barricades and flashing warning lights. Steel plate (1" minimum thickness) may be used over open trenches as temporary roadway. At a minimum, a 12-foot wide lane must be kept open for site ingress/egress.
- D. **Blasting:** Blasting or use of explosives shall not be allowed in any instance.
- E. **Disposal of Spoil Material:**
  1. Suitable material from excavations that meets the requirements for backfill material, except stripping excavation, may be reused. The remaining excavated materials shall be removed from the site and disposed in accordance with all applicable laws, ordinances, and codes.
  2. Subcontractor shall be responsible for the storage, transportation, and deposition of spoiled material and shall be responsible for acquiring the necessary permits, and the payment of fees and duties at no additional cost to the Government.
  3. No burning of materials shall be permitted on the site.

### 3.2 TRENCH EXCAVATION

Trenches shall be excavated to the alignment and depth indicated on the Construction Drawings or as necessary for the proper installation of the conduit and appurtenances. Brace and dewater the trench as required.

### 3.3 TRENCH SUBGRADE

- A. Excavate the trench to an even grade to permit the installation of the conduit so that the full length of the pipe barrel is supported at the proper depth. The entire foundation subgrade area in the bottom of the excavations shall be firm, stable material, and the material shall not be disturbed below required grade except as described in this specification
- B. Remove the material until a firm, stable, and uniform bearing is reached and the subgrade brought back to the required grade with the specified bedding material compacted

in place. The expense of replacing any unsatisfactory sub grade shall be borne by the Subcontractor.

- C. Should any part of the trench be excavated below required grade, correct the trench with bedding material, thoroughly compacted, or with lean concrete, at no additional compensation to the Subcontractor.
- D. The use of any suitable trench digging machinery is permitted except in places indicated on the Construction Drawings or where such operations may cause damage, above or below ground, in which case, employ hand methods. In pavement areas trench shall be wide enough to used compaction equipment.

### **3.4 BACKFILL**

#### **3.4.1 General:**

- A. Prior to backfilling, the owners/operators of existing facilities/utilities that were exposed during potholing or excavation shall be contacted and given the opportunity to inspect for damage that may have occurred during the excavation process. All responses and inspections shall be documented.
- B. The Subcontractor shall take care not to damage existing facilities and utilities during backfill and compaction.
- C. All material used to backfill potholed or excavated existing utilities shall be clean and free of large rocks, sharp objects, and large chunks of hard-packed dirt or clay. The requirements for backfill may be found in FAA-C-1391d, Installation and Splicing of Underground Cables. The utility owner/operators shall be contacted for additional requirements regarding their utilities.

#### **3.4.2 Bedding Placement:**

Before installation of conduit place a bedding of sand per construction. Carefully compact material under pipe haunches and bring backfill along the full length of utility piping or conduit to avoid damage or displacement of utility system.

#### **3.4.3 Fill Placement:**

After installation and testing of conduit and cable, place and compact initial backfill of satisfactory soil material or subbase material, free of particles larger than 1 inch, to a height of 12 inches over the utility pipe or conduit. Carefully compact material and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system. Where it will not cause a drainage problem, the last layer shall be made with topsoil slightly mounded in the middle of the trench.

#### **3.4.4 Compaction Requirements:**

- A. Compact earth fill and cohesive aggregate fill in maximum 4 inch lifts with pneumatic rollers or power hand tampers and make a minimum of eight (8) passes. Backfill material shall be free of particles larger than 1-inch to a height of 12-inches over utility pipe or conduit.
- B. Compact cohesionless aggregate fill in maximum 4 inch lifts with vibratory rollers or vibratory plate power hand compactors and make a minimum of eight (8) passes.
- C. The acceptability of the compaction equipment shall be based upon the results of a test section.
- D. Compact earth fill and cohesive aggregate fill to a minimum of 95% of maximum dry density as determined by ASTM D-698, Standard Proctor or ASTM D-1557, Modified Proctor by using nuclear methods.

- E. Compact cohesionless aggregate fill on which it is not practical to control the density by “Proctor” methods to a minimum of 75% of relative density as determined by ASTM D-4253 and D-4254, by a field compaction mold method correlated to ASTM D-4253 and D-4254. Compact cohesionless aggregate fill at moisture content within a range that accommodates consistent placement and compaction to the minimum relative density specified above.

<b>Compaction Testing</b>	
Beneath Column Footings	1 Test per Footing
Beneath Wall Footings	1 Test per 50 Lineal Feet of Wall
Foundation Wall/Column Backfill	1 Test per 50 Lineal Feet of Wall per Lift
Slabs-on-Grade Subgrade	1 Test per 2,000 Square Feet
Exterior Flatwork Subgrade	1 Test per 1,000 Square Feet
Parking Area Subgrade and Aggregates	1 Test per 2,000 Square Feet
Utility Trench Backfill	1 Test per 100 Lineal Feet per Lift

**3.4.5 Distribution:** Place backfill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.

**3.4.6 Restoration:** Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

### 3.5 CONDUIT INSTALLATION

General Conduit Installation Requirements:

- A. If elevations are not given in this construction document set, conduits shall be installed with cover adequate to resist construction loads.
- B. Changes in Line and Grade. In the event obstructions not shown on the plans are encountered during the progress of the work that will require alterations to the plans, the RE shall have the authority to change the plans and order the necessary deviation from the line or grade. The Subcontractor shall not make any deviation from the specified line and grade without approval by the RE. Should any deviations in line and grade be permitted by the RE in order to reduce the amount of rock excavation or for other similar convenience to the Subcontractor, any additional costs shall be borne by the Subcontractor. Changes in line and grade shall be noted on the as-built drawings.
- C. The Subcontractor shall place sections of the conduit in the trench without damage and shall properly install the conduit. The sections of conduit shall be fitted together correctly and shall be laid true to line and grade.
- D. No conduit shall be laid which is damaged, cracked, checked or spalled or has any other defect deemed by the RE to make it unacceptable, and all such sections shall be permanently removed from the work.
- E. The Subcontractor shall install warning tape on all conduits as shown on the Construction Drawing.
- F. The Subcontractor shall provide “As-Built” drawings indicating constructed locations and elevations for all installed conduit.

### 3.6 FINISHING

Finish grade to provide positive drainage and to remove any excess soil. Provide final seeding for stabilization.



**3.7 FIELD QUALITY CONTROL**

Compact backfill and appropriate embedment material to a minimum of 95% of maximum density at a moisture content of 0 to + 5% of optimum for backfill and at optimum for sand-cement embedment as determined by ASTM D-698 (Standard Proctor). Uniformly moisten or aerate the soil as necessary.

**3.8 CLEAN AND ADJUST:**

Remove surplus conduit materials, tools, rubbish, sediment, residues, and temporary structures and leave the construction site clean. Subcontractor shall return the site to its pre-construction condition unless otherwise specified or directed by the RE.

**END OF SECTION**

## SECTION 31 23 16.13 TRENCHING

### PART-1 GENERAL

#### 1.1 WORK INCLUDED

Trenches to be excavated as shown on the drawings and as provided for by the specifications.

#### 1.2 RELATED DOCUMENTS

FAA - Specification FAA-C-1391d                      Installation and Splicing of Underground Cables

### PART-2 PRODUCTS

#### 2.1 MARKING TAPE:

2 inches wide with aluminum core, with continuous word identification "WARNING - UNDERGROUND CABLE", or previously approved alternative wording.

### PART-3 EXECUTION

#### 3.1 TRENCHING OPERATIONS

- A. **Protection of Existing Utilities and FAA Cables:** The Subcontractor shall obtain utility locations from the utility owners (telephone company, electrical power service, water and gas utilities, airport operations, and FAA). FAA will mark its cable locations; provide a minimum of 72 hours advance notice. Contact local One-Call for commercial utility marking before digging, and Airport Maintenance for airport lighting and power.
- B. **Hand Excavation:** Excavation by hand is required when excavating within 5 feet of existing utility services when crossing the existing service. Trenches running parallel to an existing utility shall be separated by ten feet.
- C. **Repairs:** Subcontractor shall be responsible for prompt restoration of service to any facility impacted by construction operations. Subcontractor shall immediately repair any damage done to utilities or cables within the work area. A certified splicer shall be on call to splice cables. FAA cables shall be repaired to the standards described in FAA Specification FAA-C-1391d, Installation and Splicing of Underground Cables
- D. **Marking Tape:** Install in trenches before final placement of fill and compaction at depth of six inches. Overlap ends of rolls a minimum of three feet and tie ends together with a square knot.
- E. **Cable Markers:** Duct and cable markers are required at the beginning point and ending point of each run; at each change of direction; and every 200 feet along the run.
- F. **Backfill:** Prior to backfill, the Subcontractor shall record on as-built drawings the location and elevation of existing utilities encountered and any deviation from the line and grades shown on the construction drawings.

#### 3.2 INSPECTION

- A. **Line and Grade:** Prior to any excavation, all control points established by the Subcontractor shall be inspected by the PM Designee.

- B. **Trenching**: All cable trenches shall be inspected by the PM Designee prior to backfill. Normally, all trenches shall be backfilled on the same day they are excavated. In the event a trench or excavation must be left open overnight, it shall be properly barricaded, flagged, and lighted.

**END OF SECTION**

**SECTION 31 25 00**  
**EROSION AND SEDIMENT CONTROLS**

**PART-1 GENERAL**

**1.1 WORK INCLUDED:**

The work covered by this Section shall consist of the Best Management Practices (BMPs) for furnishing, installing, maintaining and removing temporary erosion control devices on the Project and in areas outside the construction limits where work is accomplished in conjunction with the project, so as to prevent pollution of water, air, detrimental effects to public or private property adjacent to the project limits, and damage to work on the project. Where practical, temporary erosion control features shall be constructed and maintained as outlined within the Subcontractor's approved Erosion Control Plan. Construction exits shall be a mandatory BMP on this project.

**1.2 REFERENCED SPECIFICATIONS, CODES AND STANDARDS**

- A. The American Society for Testing and Materials (ASTM) Publications: ASTM Standards.
- B. Department of Transportation: Standard Specifications for Road and Bridge Construction, Latest Edition.
- C. Natural Resources Conservation Service (NRCS): Natural Resources Conservation Practice Standards

**1.3 SUBMITTALS**

Parsons WRPM approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

**1.3.1. Erosion Control Plan:** The plan shall depict the BMPs for the erosion control measures; at the Pre-construction Conference, the Subcontractor shall present the proposed plans for installation of erosion control devices. The schedule shall be based on project conditions and shall be in written form. This schedule shall specifically indicate the sequence of earthwork operations and the proposed use of temporary erosion control features. This plan shall also outline the Subcontractor's proposed methods of controlling erosion of haul roads and areas used for waste materials from the project. This submission shall include but is not limited to the following:

- A. General overall Erosion Control Plan;
- B. Detailed breakdown of BMPs (erosion control devices) as required for different stages of construction;
- C. Set of marked plans or detailed drawings showing areas of control devices and purpose for each;
- D. Subsequent staging plans and specific site plans may be submitted to the Contracting Officer through the PM Designee for approval as the work progresses. These plans shall be submitted a minimum of two (2) weeks in advance of construction, to allow review by the PM Designee. No work shall be started until the aforementioned plans have been accepted by Contracting Officer. The Subcontractor will be responsible for accomplishment of the work in accordance with the accepted plans. The PM Designee may have changes approved that are necessary due to unforeseen circumstances that are beyond the control of the Subcontractor.

E. Plan Contents: The plan shall consider, but is not limited to the following:

- 1. Overview of Erosion and Sedimentation Control Plan

- a. General Requirements
  - b. Subcontractor Submittal
    - i. Subcontractor must review and sign the Erosion and Sedimentation Control Plan
    - ii. Subcontractor must make commitment to provide erosion and sediment control silt
  - c. No Work Until Acceptance by Contracting Officer
2. Erosion Control Schedule
- a. General Overall Erosion and Sedimentation Implementation Plan (Narrative)
  - b. Breakdown of Erosion Control Devices (Summary of Quantities)
  - c. Marked Plans or Detailed drawing showing Control Devices and Purposes
  - d. Site and Staging Plans
3. Plan Considerations
- a. Terrain
    - i. Hilly
    - ii. Flat
    - iii. Drainage Area
  - b. Soil Conditions
    - i. Clay
    - ii. Sandy
    - iii. Rock
  - c. Adjacent Property
    - i. Urban
    - ii. Rural
    - iii. Waterways
    - iv. Specific
  - d. Narrative
    - i. Worksite Erosion Control Supervisor (WECS) identified and listing of relevant qualifications
    - ii. Summary of quantities for erosion control devices
    - iii. Grassing
  - e. Plans
    - i. Before entering drainage ditches, canals
    - ii. Locations of Construction Exit onto Perimeter Road
    - iii. Location of Silt Fence and/or Gates

- iv. Type of Silt Fence.

## **PART-2 PRODUCTS**

### **2.1 BEST MANAGEMENT PRACTICES:**

BMPs shall be based on State DOT or State NRCS standards unless otherwise approved by the Contracting Officer. BMPs may include, and are not limited to:

- A. Brush Barrier
- B. Earth Berm
- C. Bituminous Treated Roving
- D. Check Dam
- E. Channel Stabilization
- F. Channel Riprap
- G. Construction Exit
- H. Diversion Channel
- I. Down Drain Structure – Flexible
- J. Down Drain Structure – Concrete
- K. Down Drain Structure – Metal
- L. Permanent Soil Reinforcing Mat
- M. Riprap Ditch Checks
- N. Riprap
- O. Retrofit
- P. Silt Retention Barrier
- Q. Sedimentation Barrier
- R. Inlet Trap
- S. Sediment Basin
- T. Silt Fence
- U. Silt Fence – Reinforced
- V. Silt Control Gates
- W. Stream Crossing
- X. Storm Drain Outlet Protection
- Y. Surface Roughening

## **PART-3 EXECUTION**

### **3.1 SCHEDULING OF SUCCESSIVE OPERATIONS:**

Operations shall be scheduled such that the area of unprotected erodible earth exposed at any one time is not larger than the minimum area necessary for efficient construction operations and that the duration of exposure of uncompleted construction to the elements is as short as practicable.

### **3.2 CONSTRUCTION REQUIREMENTS -**

#### **3.2.1 General:**

The PM Designee has the authority to limit the surface area of erodible earth material exposed by trenching and excavation, and to direct the Subcontractor to provide immediate permanent and/or temporary erosion control measures to prevent contamination of adjacent drainage ditches, canals, or other areas of water impoundment. Such work should coincide with the Subcontractor's Erosion Control Plan. Cut slopes shall be seeded as the excavation proceeds. Under no circumstances shall grading be allowed to exceed the operating range of the grassing equipment In addition to minimizing erosion, this is necessary to keep attraction to birds, to a minimum. The Subcontractor shall incorporate all erosion control features into the Project at the earliest practicable time as outlined in his accepted Plan.

#### **3.2.2 Erodible Area:**

The Subcontractor shall limit the area of excavation and trenching operations commensurate with the Subcontractor's capability and progress in keeping the finish grading, seeding and other such erosion control measures current in accordance with the accepted Plan.

### **3.3 PROTECTION DURING SUSPENSION OF CONTRACT TIME**

In the event that it is necessary to suspend the construction operations for any appreciable length of time, the top of the earthwork shall be shaped in such a manner as to permit runoff of rainwater. The PM Designee has the authority to apply temporary seeding or other erosion and sediment control measures to minimize erosion and sediment transport.

**END OF SECTION**

## SECTION 32 12 16 ASPHALT PAVING

### PART-1 GENERAL

#### 1.1 WORK INCLUDED

The work under this Section includes, but is not necessarily limited to, the furnishing and installation of all asphalt paving materials as indicated on the Construction Drawings and as necessary for the proper performance of this Work.

#### 1.2 REFERENCE STANDARDS

Unless otherwise indicated on the Construction Drawings or herein specified, all work under this Section shall be performed in accordance with the current State Department of Transportation (DOT) Standard Specifications for road and pavement design.

##### 1.2.1 American Society for Testing and Materials (ASTM) Publications

ASTM D-920	Standard Specification for Elastomeric Joint Sealants
ASTM D-6690	Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

#### 1.3 SUBMITTALS

Parsons WRPM approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Batch design.
- B. Density and viscosity tests on each run.
- C. Delivery tickets for pavement base and asphalt paving materials.
- D. Aggregate sieve analysis report.
- E. Paint manufacturer's product data sheets.
- F. Certification compliance from Hot Mix Asphalt Plant that all materials and products meet or exceed State DOT material specifications.
- G. Compaction Test results.

#### 1.4 QUALITY ASSURANCE

Before unloading at the Project, each truck operator shall furnish a delivery ticket to the PM Designee for all asphalt paving material incorporated in the Project.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location and within temperature range required by manufacturer. Protect stored materials from direct sunlight.

#### 1.6 PROJECT CONDITIONS

- A. **Environmental Limitations:** Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:
  1. Prime and Tack Coats: Minimum surface temperature of 40 deg F.



2. Asphalt Base Course: Minimum surface temperature of 35 deg F and rising at time of placement.
  3. Asphalt Surface Course: Minimum surface temperature of 50 deg F at time of placement.
- B. **Pavement-Marking Paint:** Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 160 deg F.

## PART-2 PRODUCTS

### 2.1 ASPHALT MATERIALS

- A. All asphalt materials and products for the work under this Section shall conform to the materials specified in State DOT specifications except as otherwise specified herein.
- B. Tack and prime coats shall be in accordance with State DOT Specifications.
- C. Surfacing shall be in accordance with State DOT Specifications as indicated on the Construction Drawings. The gradation shall be per table below.

Table 1- Plant Mix Surfacing Gradation

Sieve Size	% Passing Job Mix Target Bands	Job Mix Tolerances
3/4"	100	-
1/2"	83 - 93	+/- 7
3/8"	73 - 87	+/- 7
No. 4	47 - 63	+/- 6
No. 10	32 - 43	+/- 6
No. 40	15 - 25	+/- 5
No. 200	5 - 7	+/- 2

- D. Subbase Mix shall be in accordance with State DOT Specifications as indicated on the Construction Drawings. The gradation shall be per table below.

Table 2- Crushed Subbase Course

Sieve Size	Percent Passing
2"	100
1.5"	90 - 100
1"	80 - 92
3/4"	75 - 85
3/8"	50 - 65
No. 4	30 - 45
No. 40	5 - 20
No. 200	3 - 8

- E. Aggregate base shall be in accordance with State DOT Specifications. The gradation shall be per table 2.

### 2.2 PAINT

Paint for repair of airport pavement markings shall match the type and color of the existing markings in accordance with AC 150/5370-10A, Item P-620-2.

## PART-3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

- B. Proof-roll subbase using heavy, pneumatic-tired rollers or fully loaded dump trucks (20 ton minimum) to locate areas that are unstable or that require further compaction. Vehicle to have properly inflated tires and operate between 2 ½ to 5 miles per hour. Any pumping, depression or rutting of base in excess of one-half inch is considered to be unacceptable. The PM Designee must witness all proof-rolling activities. Unacceptable areas as defined by the PM Designee are to be reworked and retested until it is acceptable at no additional cost to the Government.
- C. Notify PM Designee in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

### 3.2 PATCHING AND REPAIRS

- A. **Patching:** Saw cut perimeter of patch and excavate existing pavement section to sound base. Re-compact new subgrade. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically.
  - 1. Tack coat faces of excavation and allow to cure before paving.
  - 2. Fill excavation with dense-graded, hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.
- B. Partially fill excavation with dense-graded, hot-mix asphalt base mix and compact while still hot. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.
- C. Fill holes that remain from sign post removal with Hot Applied Joint Sealant meeting requirements in ASTM D 3405.

### 3.3 SURFACE PREPARATION

- A. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subbase and base is ready to receive paving.
  - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- B. Prime Coat: Apply uniformly over surface of compacted-aggregate base at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate the surface in a 24 hour period and seal, but not flood, surface. Allow prime coat to cure for a minimum of 24 hours and maximum of 72 hours minimum.
  - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use just enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
  - 2. Protect primed substrate from damage until ready to receive paving.

### 3.4 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt mix on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness, when compacted.
  - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated on the Construction Drawings.
  - 2. Spread mix at temperature indicated in State DOT Specifications.
  - 3. Begin applying mix along centerline and on high side of one-way slopes, unless otherwise indicated.
- B. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

- C. Place paving in consecutive strips not less than 10 feet wide, except where infill edge strips of a lesser width are required.
- D. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete asphalt base course for a section before placing asphalt surface course.
- E. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.5 JOINTS

- A. Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
  - 1. Clean contact surfaces and apply tack coat.
  - 2. Offset longitudinal joints in successive courses a minimum of 6 inches.
  - 3. Offset transverse joints in successive courses a minimum of 24 inches.
  - 4. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
  - 5. Compact asphalt at joints to a density within 2 percent of specified course density.

### 3.6 COMPACTION

Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving in accordance with State DOT Specification.

### 3.7 INSTALLATION TOLERANCES

- A. **Thickness:** Compact each course to produce the thickness indicated within the following tolerances:
  - 1. Base Course: Plus or minus 1/2 inch.
  - 2. Surface Course: Plus 1/4 inch, no minus.
- B. **Surface Smoothness:** Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
  - 1. Base Course: 1/4 inch.
  - 2. Surface Course: 1/8 inch.

### 3.8 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with PM Designee.
- B. Allow paving to cure for 10 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply per State DOT Specification.
- E. Use stencils for symbols (handicapped, letters, arrows).

### 3.9 FIELD QUALITY CONTROL

- A. All material and surface tolerance testing shall be in accordance with State DOT the appropriate section for the material.
- B. **Testing Agency:** The Subcontractor will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.

- C. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.
- D. Additional testing, at Subcontractor's expense, will be performed to determine compliance of Corrected Work with specified requirements.
- E. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

**END OF SECTION**

**THIS PAGE INTENTIONALLY LEFT BLANK**

**SECTION 32 31 00**  
**CHAIN LINK FENCES AND GATES**

**PART-1        GENERAL**

**1.1        WORK INCLUDED:**

The work under this Section includes, but is not limited to furnishing labor, materials, equipment, and incidentals necessary to install chain link fencing, gates, gate operators, barrier arms and gate and barrier arm controls at the locations and alignment shown on the Construction Drawings. Also modify existing fence and gates as indicated in Part 3.00 of this Specification.

**1.2        QUALITY ASSURANCE:**

**Single-Source Responsibility:** Obtain chain link fences including accessories, fittings, and fastenings, from a single source.

**1.3        SUBMITTALS**

Parsons WRPM approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Submittals shall include shop Construction Drawings, details, fence height(s), size of posts, rails, braces, gates, gate operators, footings and associated equipment and accessories. Shop Construction Drawings shall include detailed dimensional layout information with locations of all fence, gate, equipment and roadway features.
- B. Product data in the form of manufacturer's technical data, specifications, and installation instructions for fence and gate posts, fabric, gates, and gate operators, barrier arms, controls and accessories.
- C. Project specific wiring diagrams for controlled operation of hydraulic gates and barrier arms.
- D. Operation and maintenance material from manufacturer of the hydraulic operators, and barrier arms.

**1.4        STANDARDS AND REFERENCES:**

The following standards of the issues currently in force form a part of this specification and are applicable to the extent specified herein.

**1.4.1      American Society of Testing and Materials (ASTM):**

- A. A 53- Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.
- B. A90 - Standard Test Method for Weight of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
- C. A123- Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
- D. A392- Specification for Zinc-Coated Steel Chain-Link Fence Fabric"
- E. A525- Standard Specification for General Requirements for Steel Sheet, Zinc-Coated by the Hot-Dip Process.
- F. A641- Standard Specification for Zinc-Coated Carbon Steel Wire.

- G. A824- Standard Specification for Metallic-Coated Steel Marcellled Tension Wire for Use with Chain Link Fence.
- H. C 33- Specification for Concrete Aggregates.
- I. C150- Specification for Portland Cement.
- J. F567- Standard Practice for Installation of Chain-Link Fence.
- K. F626- Standard Specification for Fence Fittings.
- L. F669- Standard Specification for Strength Requirements of Metal Posts and Rails for Industrial Chain-Link Fence.
- M. F1083-Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated Welded, for Fence Structures.
- N. F1234-Standard Specification for Protective Coatings on Steel Framework for Fences.

**1.4.2 Federal Aviation Administration (FAA)**

- A. FAA-E-2065 – Fence Fabric.
- B. RR+F-191J/GEN – Fence Posts and hardware.

**1.5 DELIVERY, HANDLING AND STORAGE:**

Store fence and gate material as recommended by the Manufacturer on-site in a staging area designated by PM Designee.

**1.6 JOB CONDITIONS:**

**Field Measurements:** Verify layout information for fences and gates shown on the Construction Drawings. Verify dimensions by field measurements. Report any differences to the PM Designee prior to any fabrication or installation.

**PART-2 PRODUCTS**

**2.1 MATERIALS:**

- A. **Chain Link Fabric:** shall be No. 9 gage wire woven in 2 inch mesh aluminum or zinc-coated (galvanized) with top selvage to have a twisted and barbed finish and bottom selvage to have knuckled finish. Conform to ASTM A 392, Class 2.
- B. **Line Posts:** shall be 2.375 inch O.D. schedule 40 galvanized-steel pipe weighing not less than 3.65 pounds per lineal foot.
- C. **Terminal Posts:** shall be 3.00 inch O.D. schedule 40 galvanized-steel pipe weighing not less than 9.11 pounds per linear foot. Use at end, corner, pull and at places where grade changes.
- D. **Gate Posts:** shall be in accordance with dimensions indicated on the Construction Drawings.
- E. **Top Tension Wire:** shall be No. 6 gage aluminum coated coil tension wire. Attach to fence fabric with by weaving into fence fabric or with fabric ties at 14-inch centers. No loose or rattling equipment will be allowed.

- F. **Bottom Tension Wire:** shall be No. 6 gage aluminum coated coil tension wire. Attach to fence fabric with by weaving into fence fabric or with fabric ties at 14-inch centers. No loose or rattling equipment will be allowed.
- G. **Braces:** shall be of the same material as the top rail. Extend braces from each terminal post to the first adjacent line post. Fasten braces securely to posts by heavy pressed steel connections and then truss braces from line post back to terminal post with 3/8-inch round truss rod complete with tightening unit.
- H. **Wire Ties:** for tying fabric to line posts shall be 9 gage zinc-coated (galvanized) steel wire ties spaced at 15 inches o/c.
- I. **Post Tops:** shall be pressed steel or malleable iron (designed as a weather-tight closure cap for tubular posts). Where top rail is used, provide tops to permit passage of top rail. Post tops shall have a tight press-fit or shall be spot-welded. No loose or rattling fillings will be allowed.
- J. **Stretcher Bars:** (for end, corner, pull or gate posts only) shall be one piece lengths equal to full height of fabric with a minimum cross section of 1/8 X 1 inch. Provide one stretcher bar for each gate, end post, and two for each corner and pull post.
- K. **Stretcher Bar Bands:** shall be heavy pressed steel, spaced not over 14 inches o/c. to secure stretcher bars to end, corner, pull and gate posts.

## 2.2 FABRICATIONS:

- A. All structural and roll formed shapes shall conform to provisions of ASTM A 123 for galvanized coating.
- B. All tubular members shall comply with provisions of ASTM A 53, Schedule 40, for weight and coating.

## 2.3 MANUFACTURED PRODUCTS:

- A. V-TRACK Sliding Gates – Not Used
- B. Double Swing Gates: shall be standard products of a manufacturer who is regularly engaged in the manufacturer of such items. They shall be located and installed as indicated on the Construction Drawings.
  - 1. Fabric for gates shall match the fencing fence unless otherwise indicated. Secure fabric at vertical edges with tension bars and bands and to top and bottom of frame with wire ties.
- C. Fabricate perimeter frames of gates from same material and finish as fence framework. Gate frame members shall be at a minimum 2.0 inch O.D. schedule 40 galvanized-steel pipe weighing not less than 2.75 pounds per lineal foot. Assemble gate frames by welding. Apply self-etching zinc chromate primer to all welded joints. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware, and accessories. Space frame members as shown on Construction Drawings. Install diagonal cross-bracing consisting of 5/16-inch-diameter adjustable-length truss rods on gates to ensure frame rigidity without sag or twist.
- D. **Barrier Arm:** Not Used
- E. **Gate Position Switch:** Not Used
- F. **Photo Beam:** Not Used
- G. **Pad Lock:** Heavy duty solid extruded brass body, stainless steel shackle, keyed for best cylinder.



## **PART-3 EXECUTION**

### **3.1 PREPARATION:**

Complete final grading prior to starting fence installation(s).

### **3.2 INSTALLATION:**

- A. Fence shall be installed by skilled and experienced fence erectors in accordance with the Construction Drawings and the manufacturer's installation instructions on lines and grades shown on the Construction Drawings.
- B. Excavation(s) shall not begin prior to completion of final grading. Confirm that there is no interference with underground utilities prior to excavation/drilling. Drill holes for post footings in firm, undisturbed or compacted soil. Place concrete around posts in a continuous pour and tamp for consolidation. Check each post for vertical and top alignment. Maximum spacing between line posts is 10 feet. Set keepers, stops, sleeves and other accessories into concrete as required. Install brace assemblies so posts are plumb when diagonal rod is under proper tension.
- C. Install tension wires before stretching fabric and tie to each post with ties or clips.
- D. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released. Pull fabric tight so that the maximum deflection of fabric is 2 inches when a thirty pound pull is exerted perpendicular to the center of the panel.
- E. Thread stretcher bars through fabric and secure to posts with metal bands spaced not over 14 inches o/c. Tighten stretcher bar bands, wire ties, and any other fasteners very securely. Fabric should not be free to move along the framework.
- F. Install gates plum, level, and secure full opening without interference. Install ground-set items in concrete for anchorage, as recommended by the manufacturer. Adjust hardware for smooth operation.
- G. Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts for added security.

### **3.3 FIELD QUALITY CONTROL:**

Upon completion of installation of the gates, gate operator, controls, and card readers, an acceptance test to verify the satisfactory operation of each gate and associated equipment shall be conducted. The test(s) shall be in a manner approved by and in the presence of the PM Designee. All gates and associated equipment must perform in a manner acceptable to the PM Designee before final acceptance will be made by the Contractor.

### **3.4 MODIFY EXISTING FENCE:**

- A. **Wire Ties:** for tying fabric to line posts shall be 9 gage zinc-coated (galvanized) steel wire ties spaced at 15 inches o/c. Remove existing aluminum wire ties and replace with steel wire ties.
- B. **Tension Wires:** shall be secured with wire ties at each and every post in such a fashion that will not allow any perceivable movement between it and the post when the fabric is flexed. Attach to fence fabric with by weaving into fence fabric or with fabric ties at 14-inch centers. No loose or rattling equipment will be allowed.

- C. **Fabric:** shall be pulled tight so that the maximum deflection of fabric is 2 1/2" when a 30-pound pull is exerted perpendicular to the center of a panel. Maintain tension by securing stretcher bars to posts with metal bands spaced no farther than 14" O/C. Fasten the fabric to the steel framework with 9 GA. steel wire ties, spaced no further than 14" O/C. for all posts, rails, braces, and tension wires. Tighten stretcher bar bands, wire ties, and any other fasteners very securely. Fabric shall not be free to move along the framework.
- D. **Line Posts:** that are bent or broken shall be replaced with 2.375 inch O.D. schedule 40 galvanized-steel pipe weighing not less than 3.65 pounds per lineal foot. Set replacement post in concrete. Demolish existing fence posts and concrete bases where indicated on drawings.
- E. **Gate Hardware:** accessories shall be firmly attached with minimum free-play and/or wear. Double gates shall have stops that provide a rigid anchor. Any locking hardware shall not be subject to free movement caused by wind.

**END OF SECTION**

**THIS PAGE INTENTIONALLY LEFT BLANK**

## **SECTION 32 92 19 SEEDING**

### **PART-1 GENERAL**

#### **1.1 SCOPE**

The Subcontractor shall furnish all labor, materials, tools, equipment, plant, and services necessary to restore to original conditions all of the areas disturbed by construction efforts. These include areas where Subcontractor is directed to seed whether or not disturbed by construction. These areas are not only immediately adjacent to active construction, but can be any area utilized by Subcontractor (including areas traversed) that has been defaced during the contract.

#### **1.2 CONDITIONS**

Seed shall be sown only when the soil is moist and in proper condition to induce growth. Fertilizing, seeding, or mulching operations will not be permitted when wind velocities exceed 15 miles per hour. When drought, water saturated soil, freezing temperatures, or inclement weather conditions prevail, the work shall be postponed.

#### **1.3 MAINTENANCE AND REPAIR**

The Subcontractor shall maintain seeded areas until final acceptance of the work is made as specified in the contract.

#### **1.4 SUBMITTALS**

Parsons WRPM approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Certification of compliance with the specifications from the material supplier for seed, fertilizer, and lime.

### **PART-2 PRODUCTS**

#### **2.1 FERTILIZER**

The numerical designations for fertilizer indicate the minimum percentages (respectively) of (1) total nitrogen, (2) available phosphoric acid, and (3) water soluble potash contained in the fertilizer. Subcontractor shall supply any commercially recognized brand of 12-8-8 fertilizer. At least 50% (percent) of the phosphoric acid shall be from normal super phosphate or an equivalent source that will provide a minimum of 2 units of sulfur. The amount of sulfur shall be indicated on the quantitative analysis card attached to each bag or other container.

#### **2.2 LIME**

The designation "fertilizing" shall include the application of an agricultural type, dolomitic limestone where indicated for by soil testing or direction of the PM Designee. The limestone may be a component of the 12-8-8 fertilizer or may be separately applied.

### 2.3 SEED

Seed shall be furnished separately or in mixtures in standard containers, clearly marked with the seed name, lot number, net weight, percentages of purity, germination, and hard seed, and the maximum weed content for each seed.

#### SEED TYPES AND MINIMUM RATES

	<u>Min. Lbs. per Acre</u>	
TYPE	MAR. to NOV.	NOV. to FEB.
<u>Permanent Grass</u>		
Unhulled Bermuda	20	20
Hulled Bermuda	20	20
<u>Quick Growing</u>		
Brown Top Millet	20	--
Annual Rye Grass	--	<u>20</u>
Total Lb./acre (Min.)	60	60

### 2.4 MULCH

Mulch shall be straw for seeds sown by mechanical seeders. For hydraulic seeding, either degradable green dyed wood cellulose fiber or 100 percent recycled long fiber pulp, free from weeds and other foreign matter toxic to seed germination.

### 2.5 TACKIFIER

Liquid concentrate diluted with water forming a transparent 3 dimensional film like crust permeable to water and air and containing no agents toxic to seed germination.

### 2.6 WATER

Fresh and free of substances harmful to seed germination.

## PART-3 EXECUTION

### 3.1 PREPARATION OF AREA TO BE SEEDED

The ground over which the seed is to be sown shall be prepared by disc harrowing and thoroughly pulverizing the soil to a depth of 6". The prepared soil shall be loose and reasonably smooth. It shall be free of clods, roots, concrete, rocks, and discarded construction, or other deleterious materials that will interfere with the work or subsequent mowing and maintenance operations. The PM Designee shall be given 72 hours advance notice to inspect the area before any application of fertilizer or seed commences.

### **3.2 PREPLANTING FERTILIZATION**

The fertilizer and/or lime shall be spread uniformly over the area to be grassed. The lime shall be spread at a rate of 800 to 1000 pounds per acre, unless otherwise called for by testing.

Immediately after the fertilizer and/or lime is spread over the seedbed it shall be mixed into the soil to a depth of approximately 4".

Straight fertilizer shall be applied in one or more applications as specified below:

- A. An initial application of 400-500 pounds per acre.
- B. Approximately 60 calendar days after the initial application, and on projects which have not yet been accepted; unless otherwise directed, subsequent applications of 400-500 pounds per acre shall be applied by mixing into the soil.

### **3.3 SEEDING**

While the soil is still loose, seed shall be scattered uniformly over the grassing area and immediately mixed into the seedbed to a depth of one-half inch. The Subcontractor may mix fertilizer and seed into the seedbed in one operation. The kinds and minimum amounts of seeds for permanent and quick growing types of seed mixture are listed in paragraph 2.3 above. The seed mixture shall be thoroughly dry mixed before application. Seed that has become wet shall not be used, nor shall it be discarded on site because of the attraction birds have to the seed.

### **3.4 SEEDING METHODS**

Seeds shall be sown by mechanical seeders or broadcasting either by hand; by hydraulic seeding in combination with fertilizer; by hydraulic seeding in combination with wood-cellulose-fiber, mulch, and fertilizer; or other PM Designee approved sowing equipment. Half the seed shall be sown with the sower moving in striated fashion across in the grassed area, then the remainder with the sower moving across in a similar striated fashion at right angles to the first.

### **3.5 MULCHING**

Mulching shall be applied to a loose thickness of approximately two inches uniformly over the seeded area and cut into the soil with equipment capable of producing a mulched thickness of 3-4 inches. Harrows will not be allowed. Care needs to be exercised that materials are not cut too deeply into the soil. When green mulch is used, the green mulch shall be incorporated into the soil not later than two days after being cut and no artificial watering of the mulch shall be done before it is applied.

### **3.6 ROLLING**

Immediately after completion of the seeding, the entire grassed or mulched area shall be rolled thoroughly with a roller or cultipacker weighing 100 to 160 pounds per linear foot of roller. The PM Designee may direct a waiting period of up to a half an hour following planting to avoid balling the soil on the roller or squeezing the water out of the burrows. If the soil is such that a smooth or corrugated roller cannot be operated satisfactorily, a pneumatic-tire roller (not a wobble-wheeled roller) shall be used. A sufficient number of passes shall be used to compact the surface to approximately the same degree as the adjacent terrain is consolidated, plus or minus 5% (percent).

### **3.7 WATERING**

Newly seeded areas are not to be watered to force the seed germination; but only to sustain grass growth. The Subcontractor shall provide water supplies, and equipment that can uniformly distribute water in a manner that will not disturb the germinating seed nor cause erosion.

### **3.8 MAINTENANCE AND REPAIR**

Maintenance shall consist of watering and mowing operations and protecting such areas from traffic. The Subcontractor shall mow the grassed area if the vegetation's height exceeds 12" and Subcontractor's responsibilities under this contract have otherwise been met. Repair shall consist of re-establishing seed areas damaged by traffic, erosion, drought, fire, run-off from watering or rain, or standing water. Such areas shall be re-seeded in accordance with this specification until a 95% (percent) covering of the area by mature, well-rooted grass is achieved.

**END OF SECTION**